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Nitrous Oxid-Oxygen Anesthesia —*McKesson*

Occlusion and Monson Theory—*Wolfson*

SYMPOSIUM ON FOCAL INFECTION

Review of Literature—*Hartzell*

Human Pathology—*Miloslavich*

Laboratory Myths and Truths—*Rickert*

Relation to Surgery—*Beck*

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Original Communications

THE ESSENTIALS OF NITROUS OXID-OXYGEN ANESTHESIA WITH A REVIEW OF ITS USE IN AMERICA*

By E. I. McKESSON, M.D., Toledo, Ohio

NITROUS oxid is an anesthetic by virtue of a singular combination of circumstances, including possession of such properties as low boiling point, stability in living tissue and great solubility in body fluids, together with the higher demand of nervous tissue than of other tissues for oxygen. These are the essential factors. A closer analysis is necessary to appreciate their importance and bearing.

Nitrous oxid boils at −135 F., while ether boils at +98 F.—an enormous difference. Ethylene boils at −137 F.—practically the temperature at which nitrous oxid boils. Other things being equal, the boiling point determines the rate of diffusion, the rate of elimination or the speed with which the patient recovers consciousness after the inhaler is removed. The high molecular activity of nitrous oxid at body temperature causes this gas to rush out of the blood and lungs at a tremendous rate, when the inhaler is removed. Ether requires much greater time for elimination, owing to (1) its higher boiling point and (2) the fact that, unlike nitrous oxid, its elimination is delayed by its union with various lipoids in the body, but particularly those found in the nervous system.

Ethylene has a low boiling point,

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Sixty-seventh Annual Session of the American Dental Association, Louisville, Ky., Sept. 23, 1925.

and therefore the patient goes to sleep quickly, as with nitrous oxid, and he recovers much more rapidly than after ether anesthesia on this account. But ethylene is an alcohol derivative and a fat solvent, which delays its elimination somewhat; hence, the restoration of consciousness is much slower than after nitrous oxid in anesthesias of more than five or ten minutes' duration. The last traces of ethylene, moreover, are not eliminated from the breath until after two or three days, owing to the tenacity with which it is held in the body.

A good anesthetic must be soluble in the circulating mediums of the body, and carried in a manner similar to food and oxygen, if it is to be readily absorbed and eliminated. It should not form any more or less stable compounds with any tissue or substance of the body, such as does ether or chloroform.

The functional capacity of all living tissue depends on (1) a certain supply of food substances and (2) a supply of oxygen. We shall find that the oxygen dissolved in blood serum plays an important rôle in anesthesia. Our older conceptions of what anesthesia is and how it is produced are not only inaccurate but also fail utterly to explain the symptoms or signs exhibited by the patient.

Loss of consciousness by the aviator, mountain sickness, carbon monoxid asphyxia, coma from the asphyxia of pneumonia, the convulsions of acute anemia (anoxemia) and a great many other conditions show signs and symptoms similar to those encountered in almost every narcosis. There is a common relationship. The common factor is oxygen, with its relation to the activities of certain cells in the brain and to other tissues.

It now appears that anesthesia depends on an effective mechanism for reducing the activity of certain brain cells probably by reducing the availability of oxygen, while the quantity of oxygen carried by the blood serum may be quite adequate for the function of other tissues. The aviator who flies too high (without an extra supply of oxygen) loses consciousness (becomes cyanotic), and falls until an atmosphere richer in oxygen is again inhaled when he may regain consciousness in time to right his plane. He is partly anesthesized because he finds the oxygen molecules at high altitudes widely separated or the partial pressure of this gas so low that the blood serum and lymph as well as the hemoglobin carries much less oxygen than normal from the lungs to the tissues.

Carbon monoxid asphyxiates and causes unconsciousness by saturating the oxygen-carrying bonds of hemoglobin with carbon monoxid, thus preventing the inhaled oxygen from being absorbed and carried by the blood to the tissues in sufficient quantity to satisfy more than the minimum requirements for life or even less. The result is the same, but the mechanism differs from anoxemia in the aviator. In animals having no hemoglobin, carbon monoxid has no asphyxiating effect in the presence of oxygen. Carbon monoxid, although it produces unconsciousness, is a bad anesthetic, because it is not readily eliminated and it destroys the hemoglobin. It has, therefore, unsatisfactory side-actions; which also applies to many anesthetics.

To understand how the supply of oxygen to the tissues may be so altered as to produce anesthesia, we must discuss the transport of gasses through the blood and lymph and observe a few of the more important relations which oxygen bears to nitrogen and nitrous oxid in particular. Arterial blood normally carries about 18.5 per cent by volume of oxygen. Nearly all of this oxygen is united with hemoglobin in the form of oxyhemoglobin, which acts as a store from which oxygen is liberated into the blood serum in its travel through the tissues, as oxygen is absorbed *from* the serum. The serum, therefore, is the medium of exchange between the air and the hemoglobin in the lungs, and between the hemoglobin and the tissue cells throughout the body. It contains a small amount of oxygen, 0.24 per cent by volume (Haldane). Our body cells live in an environment of 0.24 per cent, much as fishes derive their oxygen supply from water carrying a similar low percentage of oxygen.

Although the air we breathe contains about 80 per cent nitrogen and 20 per cent oxygen, the blood takes up only 1.7 per cent by volume of nitrogen, which is, however, seven times as much as the oxygen carried by the blood serum. From this 7: 1 mixture in the serum, the cells have no difficulty in obtaining plenty of oxygen for normal oxidation or combustion. If the nitrogen is relatively increased by breathing air over and over until much of the oxygen has been consumed[1] (a method employed for testing the efficiency of aviators), the oxygen percentage in the blood serum is decreased until certain less important activities of cells are interrupted for the want of oxygen. Such effects as loss of coordination, drowsiness or sleep are produced by this anoxemia.

Nitrous oxid produces such effects with greater ease and speed and also without so much disturbance of the quantity of oxygen actually carried in the hemoglobin if oxygen is also mixed with this gas. The solubility in blood serum is the secret of superiority of nitrous oxid.

Greene has shown that blood serum dissolves 26 per cent by volume of nitrous oxid, which is about fifteen times the solubility of nitrogen, and more than 100 times that of oxygen (0.24 per cent by volume). Thus, nitrous oxid is more readily soluble in serum than oxygen is in serum and hemoglobin.

This leads us to the observation, through the law of partial pressures of gases, that there are so many molecules of nitrous oxid in the serum that the oxygen molecules are crowded apart or diluted, a slowing up of chemical change being thus effected in the most susceptible brain cells, resulting in sleep, lack of coordination, etc., while other functions requiring less oxygen per minute may proceed with little, if any, interference.

Taschiro's[2] demonstration that gray nerve fibers use much more oxygen than other tissues, together with the fact derived from many sources that asphyxia causes loss of consciousness, offers a plausible explanation for the fact that

1. Greene, C. W.: J.A.M.A., 85: 645 (Aug. 29) 1925.

2. Taschiro: A Chemical Sign of Life, University of Chicago Press.

a patient may be made unconscious without damaging any tissue.

This great solubility in the body fluids explains the difference between nitrous oxid and nitrogen. It explains why oxygen is crowded out or diluted in the serum even when the red corpuscle carries enough oxygen to make the patient pink. It furthermore makes clear why a mixture of 80 per cent nitrous oxid and 20 per cent oxygen may produce anesthesia, while the same proportions of nitrogen and oxygen, constituting the air, has no anesthetic effect whatever. It further explains why the two gases have such different actions although neither is used in the body nor causes any chemical change or side-actions detrimental to any tissue or cell.

Conducting a narcosis reminds one of traveling along a dark corridor. The anesthetist first locates one wall by the signs of light anesthesia, then touches the other wall of deep narcotic signs; notes the margin of mixture proportions, then attempts to steer a straight course midway between these two extremes. To be successful, he must recognize the signs of light anesthesia on one hand and those of deep anesthesia on the other. Theoretically, this represents the major part of the technic of anesthesia. There is in dental surgery the necessity, also, of administering the gases under sufficient pressure to prevent the patient's breathing air through the mouth during operation.

CYANOSIS

Cyanosis is due to a lack of oxygen in the hemoglobin. The degree of oxygen-unsaturation of the hemoglobin, therefore, determines the degree of cyanosis. In nitrous oxid-oxygen anesthesia, cyanosis is not in itself a danger signal, nor is its absence to be relied on as a sign of safety, since the color of the blood depends on the relation of the total hemoglobin in the body to the oxygen tension in the inhaled gases. In this, it differs from the cyanosis indicating danger in ether anesthesia. In this anesthesia, one may judge by the color of the blood obtained with certain gas-oxygen mixtures whether the patient possesses a large or a small quantity of hemoglobin, which is sometimes of interest. Cyanosis sometimes develops before the patient is unconscious; at other times patients are pink yet anesthesized. In fact, the color of the blood is not an indication of the degree of anesthesia. Misinformation concerning cyanosis has resulted in more failures in anesthesia than any other cause except ignorance of the true signs of anesthesia.

MARGIN OF ANESTHESIA

If all cells were equally affected by oxygen-want, respiration and other important functions would cease with the onset of anesthesia. When a patient is changed from light to very deep anesthesia by very slight changes in the mixture of nitrous oxid and oxygen, such as 1 or 2 per cent, the margin of anesthesia is said to be narrow; but if considerable change (from 3 to 5 per cent or more) is possible without much alteration in the depth of narcosis, the margin is broad. Now the margin of anesthesia probably corresponds to the difference in metabolism (the demand for oxygen) between those brain cen-

ters having to do with memory, reason, perception, etc., and those for the more basic or primitive and stable parts of the nervous and muscular systems.

SIGNS OF ANESTHESIA

Light Anesthesia.—The degree of anoxemia produced in the upper centers of the brain and other tissues, and therefore the depth of anesthesia may be readily estimated by certain very simple and primitive muscular responses. If only partly anesthetized, the muscles respond reflexly to pain-producing stimuli. In this plane, the pupils react to light briskly and the lids close on irritation to the conjunctiva; the eye balls rotate quickly, and there may be talking or phonation. The respiration is often irregular, with a tendency to prolong the inhalations or to hold the breath momentarily with the lungs filled.

Normal Anesthesia.—Normal anesthesia is characterized by regular breathing, slow rolling of the eyeballs, smallness of the pupils and stillness and relaxation of the muscles. But most of all it is indicated by the absence of reflexes when the operation is begun. Most dental operations are performed under light anesthesia, and this is permissible if it is deep enough to abolish resistance, persistence of memory and shouting. It is safer, however, from every point of view, to have the patient in normal anesthesia rather than in light anesthesia.

Deep Anesthesia.—If there is too much anoxemia, that is, the anesthesia is too deep, a more complicated muscular manifestation, with either twitching, jerking or muscular rigidity, usually takes place, although occasionally, in very weak individuals, great relaxation occurs instead. This spastic rigidity or twitching or jerking is often erroneously interpreted as excitement indicating that the patient is not "under," when in reality he is showing gross anoxemia and is really too deeply anesthetized. More oxygen in the mixture is required to correct this condition. Phonation or a prolonged cry is often associated with too deep anesthesia. It may be corrected by an increase of the oxygen administered.

In the case of drug addicts and alcoholics, the twitching of anoxemia is usually produced before the patient loses consciousness, but even in these exceptional cases, after five to ten minutes has elapsed, in which saturation to a degree takes place and anesthesia is established, the usual muscular reactions described above are as typical as in normal patients. Hence, one is always able to determine the depth of anesthesia by observing the reactions of the various muscles as just described. There are no other signs worth mentioning. The respiratory muscles, eye muscles and muscles of the body generally, even the position of the fingers, will guide a trained anesthetist as to the depth of anesthesia. All signs taken together are, of course, more reliable than any one group alone, but the respiratory are the best single group of muscles to observe.

NAUSEA

Swallowing, retching and vomiting by a patient whose stomach contains no food is usually a manifestation of anoxemia similar to "mountain sickness." An increase of oxygen for a

breath or two commonly aborts the symptom before vomiting takes place.

RESUSCITATION

Since, roughly, 100 times more nitrous oxid than oxygen is required in the tissues to produce anesthesia, and since nitrous oxid has no affinity for the tissues, there is no difficulty in restoring oxygen when it is inhaled or forced into the lungs. Anoxemia is thus quickly relieved, restoring normal or light anesthesia within a few moments. This is the fundamental basis of resuscitation with oxygen when it is forced into the lungs.

The effects of pure oxygen are obtained in the brain, as indicated by the eye and other reflexes, within from three to seven seconds after it is administered. When pure oxygen fills the lungs, the hemoglobin is not only saturated with it, but the blood serum carries 2.2 per cent or five times as much as normal. (Haldane.) At the same time, nitrous oxid rushes out of the blood into the lungs, and thus its concentration is reduced in the blood and the oxygen is given a still greater advantage.

"From the standpoint of physical chemistry, the partial pressure of a gas in solution is simply the vapor pressure of the dissolved gas, i. e., its tendency to pass out of the solvent at any free surface." (Haldane.) The lungs are such a "free surface." Nitrous oxid leaves the blood through the lungs at a marvelous velocity, when the lungs are filled with oxygen.

The blood remains in the pulmonary alveoli for only one second (Greene), but in two-fifths second, the hemoglobin is 96 per cent saturated with oxygen, changing it from venous to arterial blood in that short interval. The flow of blood plus the passage of oxygen through the serum and lymph into the cell, and the chemical change, all together, require the remainder of the three to seven seconds, which may be clinically demonstrated on any patient.

By measurement in clinical practice, oxygen is absorbed from the lungs at the rate of slightly more than 1 liter per minute—a volume sufficient to saturate 20 liters of blood with oxygen. In less than twenty seconds, therefore, all of the arterial blood of a patient may be saturated with oxygen.

Therefore, if a patient stops breathing, whether it is due to interference with the airway from operative manipulations or from "crowding" the anesthetic, respiration may be readily started provided oxygen is promptly forced into the lungs once, twice or three times. Until the dentist understands the truth of this statement and is prepared and able to inflate the lungs with oxygen at will, he is unprepared to handle all patients who may come in for operation; nor will his anesthetics be as safe as they should be. He should not attempt to administer gas through an apparatus with which he is unable to control definitely the mixture of gases, increase or decrease the pressure and inflate the lungs with pure oxygen with little delay or manipulation.

Hewitt and others have reported fatalities (and such may still occur), which are easily prevented with suitable equipment and a knowledge of the facts just stated above.

The dental profession, however, is

not guilty of neglect to read and to attempt to obtain the necessary knowledge, since in no language has nitrous oxid-oxygen anesthesia been so adequately or accurately described as understood and practiced by many of its users. Most textbooks on anesthesia are written from the ether and chloroform standpoint—some of the authors haven't used enough nitrous oxid-oxygen (without ether) to know just how pure gas-oxygen acts. Their statements show it.

Many have failed in gas-oxygen anesthesia because they did not know the signs of anesthesia and were afraid of cyanosis. In the full blooded and more resistant patients, they failed to push the anesthetic far enough or did not give the patient sufficient time in which to absorb the nitrous oxid well. This general or secondary saturation is a slow process, when produced with ordinary anesthetic mixtures requiring as much as from ten to twenty minutes. The primary saturation of the blood with nitrous oxid is rapid—a matter of a few seconds; but it is incomplete, and many difficult patients are not so quickly anesthetized and are not ready for operation for some minutes or until the respirations become regular and the pupils sluggish in their reaction to light; the conjunctiva becomes insensitive to touch, and the muscles are quiet. Even then, one should begin operating cautiously, noting whether there is any reflex to trauma. If reflexes are present, a larger percentage of nitrous oxid may be required to secure the proper depth of anesthesia, provided this increase of nitrous oxid does not cause signs of marked anoxemia (such as prolonged exhalations, expiratory phonation, dilated pupils or spastic muscles). If these signs are about to be manifested, it is better simply to continue the old mixture of the two gases, allowing the patient more time in which to increase the general saturation and the elimination of nitrogen, and thus deepening the narcosis by the substitution of nitrous oxid.

High gas pressure at the inhaler and the prevention of air inhalation is absolutely essential. Any patient may be anesthetized if properly handled.

LOCAL ANESTHESIA COMPARED

By any method or agent with which we are familiar today, anesthesia may be the result of anoxemia. How that anoxemia is brought about may differ with the agent. Conductive or local anesthesia undoubtedly gets its action by restricting the oxygen supply, along the nerve trunk (in the case of conductive) and to the tissues direct, under infiltration. Whether temporary ischemia is present or not, the presence of procain, for example, produces a state of local anoxemia. Healing is slower and there is more "after pain." Local anoxemia in a traumatized and infected tissue fosters the progress of partial aerobic infections, such as the streptococcic. The local anesthetic is also capable of producing convulsions and other symptoms of gross or general anoxemia when it is absorbed in sufficient doses.

The longer an anesthetic is retained in a tissue after it has served its purpose, the greater is the danger of permanent damage to that tissue. Ether, for example, seldom kills at once if well handled, but it often paves the way by its retention in the body, for the de-

struction of any damaged organ. Local anesthetics also have the disadvantage of being retained in the tissues for relatively long periods. Nitrous oxid is more quickly eliminated than any other anesthetic.

THE QUESTIONNAIRE

In order to determine to what extent nitrous oxid-oxygen and other anesthetics are being used in the extraction of teeth and other relations to the practice, a questionnaire was sent out a few weeks ago. Of those which were promptly returned, 130 were answered sufficiently completely for tabulation and analysis. This 130 includes the reports from most of the well-known exodontists in this country. A conservative estimate would place the number of patients who have been operated on by these 130 specialists at 500,000. This report, therefore, represents the conclusions of the most active minds in this particular field of anesthesia. It is believed to be a fair cross-section view of the practice in America.

Answers to the first question show that 80 per cent of the 130 reporting use nitrous oxid-oxygen anesthesia in more than 75 per cent of their operations, or 60 per cent of all extractions are done under nitrous oxid-oxygen; 18 per cent employ nitrous oxid and oxygen exclusively; 31 per cent employ nitrous oxid and oxygen in from 90 to 99 per cent of their operations; 30 per cent in from 75 to 89 per cent; 15 per cent in from 40 to 74 per cent; and 6 per cent in less than 40 per cent. Three use nitrous oxid without oxygen.

There are eighty-nine who employ conductive anesthesia in varying proportions of their cases and seventy-two that also employ infiltration. Twenty-eight under certain circumstances (largely in hospital cases) employ ether, ethyl chlorid, ethylene, etc., but there is no mention of chloroform.

Answering the second question, when a number of teeth are to be extracted in a handicapped patient, with such complications as arthritis, anemia, heart disease, diabetes, nephritis or hyperthyroidism, thirty-six remove all the teeth required at one operation; while seventy-six divide the operation, removing but few teeth at a time, and fourteen are governed by individual circumstances. Four did not answer the question.

This shows a considerable difference of opinion about the practice of removing a few or many teeth at one operation. In the history of this operation, removal of a few teeth at a time was the rule before we had anesthesia; then, with nitrous oxid alone, which was the dental anesthetic for so many years, only a few operators were able to take more than a few teeth at an administration. Experience has shown that it is not clinically practicable, and perhaps in certain cases it is unsafe, to remove a large number under infiltration or conductive anesthesia. This leaves general anesthesia for extensive operations at one sitting.

It is noteworthy that of the twenty-three who operate under nitrous oxid exclusively, fourteen prefer to complete the operation at one sitting. No one answering this question recommended the use of conductive anesthesia for the extraction of a large number of teeth, and only four thought its use was indicated for the removal of a few teeth in handicapped patients.

The anesthetic selected for the handicapped patient was as follows: nitrous oxid, preferred by 89; either nitrous oxid or infiltration, by 17; infiltration, by 12; conductive, by 4, and ethylene, by 3. Five failed to answer the question.

This analysis shows that nitrous oxid-oxygen is considered better suited for extensive operations in handicapped patients, and this conclusion is in harmony with the findings in hospital practice for other operations.

In the notes on a few of the questionnaires, acute conditions were pointed out as contraindictions for the extraction of many teeth at one time, to which there can be no objection, provided the term acute is defined as an infection of intensity, of short duration, with the constitutional symptoms showing lack of resistance, such as a spreading infection with redness, pain, edema, fever or coma, or some acute general condition from which the patient may die within a few hours, such as cardiac decompensation, endocarditis, diabetes or the terminal states of hyperthyroidism. With the exception of those presenting local infections about the head, neck and mouth, arising from dental conditions, these patients seldom visit the dental office; nor is the dentist very often called on to extract teeth from a patient actually dying of some constitutional disease. Hence, the average run of patients may safely have complete operations under general anesthesia at one sitting. Under local or conductive anesthesia, because of certain disadvantages peculiar to them, serial operations may be the lesser of the two evils.

It is my opinion that these operations are generally the result of the following situations: (1) expediency, (2) fear of infections from experiences following local anesthesia, and (3) fear of general anesthesia or shock. Expediency covers the dentist's situation when a general surgeon advises the dentist to remove a few teeth at a time, when he has already removed the uterus and appendix, repaired the perineum and excised a wart on the neck, all at one operation—a procedure 100 times more dangerous than the extraction of all the teeth.

To remove one tonsil but leave the other with the patient under general anesthesia would be good grounds for a malpractice suit—and justly so, for the operation is only half done. On the other hand, to do a tonsillectomy while the patient was suffering from an acute peritonsillar abscess is also grounds for malpractice, since incision and drainage of the acute abscess is all that is indicated until the acute condition subsides.

Extraction is a logical means of securing adequate drainage of an acute periodontal abscess, but the occasion of the extraction is not the best time to remove other teeth.

To remove one pus tube that is in a subacute or chronically infected condition, leaving the other for a subsequent operation is, I believe, no poorer surgery than to remove one or two chronically infected teeth, leaving others to become acutely infected or to aggravate the patient's general condition. Extracting a few teeth at a time is often a cloak to hide inefficiency in general anesthesia or lack of surgical skill. It rarely conserves the best interest of the handicapped patient.

I have never seen a death from shock following a dental operation. There have been a few deaths from anesthesia under both local and general. But most deaths occur from the disease or from infection.

In this series, estimated at 500,000 patients, there were forty-one deaths from all causes which were so directly associated with the extraction of teeth as to be remembered and reported. Twenty-four died following the removal of many teeth, while seventeen deaths followed the extraction of one or two teeth. The numbers are too near each other to be conclusive. It is probable that the more extensive operations were often performed on patients with more serious pathologic conditions outside the mouth and that the number of teeth removed had little if anything to do with the death rate.

Incomplete data prevent a classification of the causes of deaths reported, but in a majority of cases given in detail, death took place several hours or days after the operation. No doubt in most cases it was due to the progress of of the condition or disease of the patient rather than to the operation or anesthetic.

There is no measure of a patient's resistance to an infection, nor to the virulency of infections, which may be applied before an operation. The blood count is used, but it is unreliable, as every surgeon knows, and until new tests are discovered, the death rate will probably remain uninfluenced by the number of teeth removed.

These forty-one deaths give a mortality rate of one in 12,000, a remarkably low figure considering the large variety of physical states, with little or no medical preparation in the vast majority. This low death rate is probably not duplicated in any other operation, regardless of age, sex or other considerations.

The extraction operation is apparently one from which the human race has become fairly immune to the danger of immediate death. This should not deceive one, or lead to the belief that carelessness is justifiable; but it does show that under the best practice of exodontia, it is not more dangerous to life than the ordinary conditions under which we live, perhaps safer than a "joy ride."

From the standpoint of postoperative morbidity, there were fifty-one who reported that the physical condition of the patient had been made temporarily worse in some of their cases; while seventy-two reported no changes of this sort. There were a number who made comparisons of the effects of anesthesia, the following case report, taken from one paper, being quite typical of several:

> One lady had twenty-eight teeth (infected) to be removed. She had four removed under infiltration, after which she was sick for ten days. She then had three removed under infiltration, and was sick for two weeks. The twenty-one remaining were removed under gas-oxygen at 2:00 p.m., and she was able to prepare supper for her family. There was good drainage and no absorption.

The type of anesthesia undoubtedly is a factor in morbidity, since ninety-five of 111 answering the fifth question point out that healing is slower after infiltration and conductive anesthesia than after nitrous oxid-oxygen. Regarding postoperative pain, 106 of 113 say that there is more pain after infiltration and conductive anesthesia than after nitrous oxid-oxygen. Slow healing and pain usually mean infection.

Comparison as to postoperative hemorrhage in anemic patients was inconclusive, fifty-five claiming less

hemorrhage after nitrous oxid-oxygen; twenty-five noting no difference, and twenty claiming less postoperative hemorrhage after infiltration and conductive. Quoting from one paper (whose author uses conductive anesthesia extensively): "There is no question: the blood clot forms more quickly under nitrous oxid."

The degree of efficiency in anesthesia which these 130 operators claim is of interest: fifty-eight are able to handle all patients with nitrous oxid-oxygen; seventy-two have some failures, ranging from 0.5 to 15 per cent.

Answers to Question 9 on this point show local and conductive anesthesia to be less efficient; twenty-one reporting no pain *during all* operations, and eighty-eight, failures, ranging from 1 to 50 per cent. Nine did not indicate their percentage of failures.

The use of premedication was reported by fifty-four, while seventy-five do not employ it. Morphin, hyoscin-morphin-cactin, chlorotone or pantopon are administered, usually from twenty minutes to one hour before operations. Morphin with atropin is also mentioned. It is apparent that premedication is rather infrequently used in the office, but more commonly employed in hospital cases.

There are two main objections in office practice to the use of narcotics before operations: (1) postoperative nausea is increased; (2) evacuation from the office is slower. However, in known difficult subjects, a No. 1 tablet of hyoscin-morphin-cactin dissolved under the tongue about forty-five minutes before the operation is an aid for those whose technic or equipment is defective in nitrous oxid-oxygen. Any patient, however, may be anesthetized without morphin or other narcotics, with suitable technic.

As to the technic of anesthetization, 115 of 126 answering Question 11 prefer to be governed by signs of anesthesia rather than by the use of a definite mixture and fixed time. The signs most frequently mentioned were: regularity of respiration, conjunctival insensitivity, general muscular inactivity, downward fixation of the eyeballs, condition of pupil and color. One reports using cyanosis as a guide!

Regarding instruction in anesthesia, 115 think that general anesthesia does not receive sufficient attention in dental colleges. Although two-thirds believe it desirable that the student become proficient in the administration of gas-oxygen, a majority indicate that postgraduate instruction is also necessary. Commenting particularly on this question, one teacher describes his course as follows: "Juniors: thirty-two hours, lectures and quizzes in local, with practical application after Christmas. Seniors: thirty-two hours, lectures and quizzes on general. Juniors and seniors attend all practical general cases in a special clinic." He states further that students while in college certainly should be taught this most important subject and required to pass examinations.

Another points out that a large amount of charity work is done by dentists, which, together with cases from asylums, prisons and county and city institutions, etc., would furnish ample material for proper instruction in general anesthesia if the students were required to administer every anesthetic under direct supervision.

From personal experience, I am sure the only way to interest the student and to lead him to take responsibility while

learning anesthesia is *not* to demonstrate to him but to have him administer the anesthetic under supervision. If 60 per cent of the extractions are performed under nitrous oxid-oxygen, it would seem that all dental colleges should offer an adequate course of instruction, which few now require.

Ethylene-oxygen, the new anesthetic, has been used by forty-seven of the 130 reporting. This shows the progressive state of the dental profession toward anesthesia. Eleven prefer it, while thirty-three refer to it as less desirable than nitrous oxid-oxygen, and three can see no difference.

Commenting on ethylene, one correspondent says that it is "absolutely undesirable to the anethetist who knows how to give gas-oxygen, but indispensable to the large proportion of unskilled anesthetists, who have to lean on a 'synergist' as a drunk man against a lamp post."

Quoting from another paper: "Have had one explosion with ethylene and oxygen and one with nitrous oxid and ethylene—each 50 per cent (mixed) with oxygen." I can do as much with nitrous oxid-oxygen as with ethylene-oxygen and not have the mental worry of explosion. Why use ethylene?

Another reports that he used ethylene in 500 consecutive cases. He finds it less desirable, though affording slightly better anesthesia, but often attended with more hemorrhage, 300 per cent more nausea and other unpleasant after effects.

Although ethylene-oxygen has found a place in hospital practice, as shown in the above quoted answers, it appears to be undesirable in the dental office.

DISCUSSION

J. A. Heidbrink, Minneapolis, Minn.: The discussion I had prepared for Dr. McKesson's paper was based upon the copy he sent me ten days ago. Late yesterday afternoon, I found at my mail box another paper from Dr. McKesson, with a note attached saying that he had made some changes and hoped I would have time to read the paper over before the discussion. Time did not permit of redrafting the whole discussion. Some data contained in the first paper and omitted in the second are so interwoven in my discussion that it is impossible to separate them without a redrafting, but the sequence of the discussion can, I think, be followed, and, in closing the discussions, Dr. McKesson will have opportunity to suggest any corrections or eliminations he wishes made. In the first paper, Dr. McKesson did not go into any detailed description of technic and, naturally, I presumed that "secondary saturation" for controlling the more difficult types of patients included producing symptoms described by Dr. Harmes as being quoted from Dr. McKesson.[3] The symptoms of secondary saturation as there described as follows:

"Respiration: (*a*) irregular rhythm (sobby) usually slower than normal; spasmodic; (*b*) prolonged expiration; (*c*) cessation of respiration from spasm of muscles of exhalation. Muscular phenomena: (*a*) clonic movements, twitching or jerking in early minutes of induction often starting in upper eyelids; (*b*) expression wild; (*c*) swallowing, retching or vomiting a common occurrence; (*d*) tetanic spasm, marked rigidity; opisthotonos in some cases. The eye: (*a*) pupils fixed, enlarging progressively and finally becoming irregular in shape; (*b*) conjunctiva insensitive; (*c*) eyeballs fixed in some position or jerk; (*d*) eyelids stiff, often wide open. Color of skin: (*a*) usually cyanotic; (*b*) in anemics, slightly flushed; rarely cyanotic; (*c*) in plethorics, almost black."

The technic for secondary saturation described in this paper is quite different, and I can more nearly agree. Here he says that, with difficult patients, secondary saturation is accomplished slowly, requiring as much as ten to twenty minutes, and if the patient does not promptly become anesthetized, a larger percentage of nitrous oxid may be used to

3. Harmes: Management of Patients Under Nitrous Oxid Oxygen Anesthesia for Open Mouth Work by Secondary Saturation, Cur. Res. Anes. & Anal., December, 1922.

secure the proper depth of anesthesia, provided this increase of nitrous oxid does not cause signs of marked anoxemia; such as prolonged exhalations, expiratory phonation, dilation of pupils, or spasticity of the muscles. The term secondary saturation is apparently undergoing a modification as to its meaning, and I wish to congratulate Dr. McKeeson on this step in the right direction. I do not agree with the contention that every patient should be anesthetized with nitrous oxid. It would be difficult to control some of the more resistant patients, who might begin to struggle during the twenty minutes required for the secondary saturation. Dr. McKesson sets forth the theory that nitrous oxid produces anesthesia by depriving the nerve cells of a portion of the oxygen normally supplied to them. He also describes in interesting detail the effects of the coincidental oxygen reduction on other of the body tissues. He points out that anesthesia is made possible because of the higher demand of the nervous tissues than of other tissues for oxygen, and that the anesthesia margin in a given patient is determined by this difference: i. e., the difference between the demand of nervous tissues and of other tissues of the body for oxygen. When there is a fair margin of anesthesia, the nerve cells may be deprived of sufficient oxygen to produce narcosis without depriving other tissues of the necessary oxygen to support their metabolism. Anything which increases general metabolism more than it does that of nerve tissue narrows the anesthesia margin, and the margin may be so small that, during anesthesia, variations in oxygen of 1 or 2 per cent make the anesthesia light or very deep. Evidently, then, any considerable further narrowing of the margin would eliminate the margin altogether, and a condition would result wherein the removal of sufficient oxygen from cerebral centers to produce narcosis would reduce the oxygen to the muscle tissue below the minimum requirement to support satisfactory metabolism, and any degree of anesthesia in such a patient would be asphyxial in character. When an anesthesia margin exists and the anesthesia is maintained within its limits, the patient is likely to be quiet and the anesthesia satisfactory; but when the patient must be carried into an asphyxial stage in order sufficiently to suppress cerebral centers to produce anesthesia, there is likely to be struggling sufficiently strenuous to be disconcerting to the operator, and dangerous to a patient of apoplectic tendencies or with myocarditis or any other atheromatic condition. Dr. McKesson suggests the remedy for patients with little or no anesthesia margin when he says "undoubtedly morphin, chloretone and all drugs used for premedication broaden the margin of anesthesia and increase the safety of narcosis." (This appeared in the first paper but not in the second.) Surgical anesthetists recognize this, and premedication is routine practice in most hospitals. I quite agree and I wish to emphasize this point. Most inconsistent with these facts is the statement that premedication is only for those whose technic is faulty. It is difficult to conceive, but quite apparent, that Dr. McKesson would deny patients who need the increased margin and safety the premedication which all agree produces it. He would have us crowd such patients into asphyxial stages necessary to control them in order that he may say that all patients can be anesthetized with nitrous oxid without premedication. The question is not "can we?" but "should we?" so anesthetize *all* patients. Even if it is possible to render all patients unconscious with nitrous oxid, some will not be sufficiently quiet for satisfactory operative procedure. I have in mind two such patients, with little or no anesthesia margin. One was a comparatively young man, an admitted alcoholic, whose nerves were so shattered that he refused to permit any dental operations while conscious. It was decided to perform a root amputation on a central incisor, which was abscessed, and he was referred to me for this work to be done under gas anesthesia. Also, there were three teeth to be extracted and several cavities to be prepared and filled with amalgam under anesthesia. After inhaling the anesthetic for twenty seconds, the patient began a violent struggling and yelling, which continued for nearly five minutes, although the anesthetic was promptly discontinued. I told him that he did not take the anesthetic well. He replied "Probably not. While being anesthetized at a hospital, it took five men to hold me on the table." Time did not permit premedication at this sitting, but on the following day one-fourth grain of morphin injected an hour previous to anesthetizing caused the patient to take the anesthetic in a normal way. He presented a fair anesthesia margin and was easily carried into anesthesia for one hour and a half, during which time all of the work was completed. The other patient was over 6 feet tall and weighed 250 pounds, with teeth and jaws in proportion.

Seven teeth were to be removed. On being seated in the chair, he said that he had come all the way from an adjoining state in order to take gas. In his face were unmistakable signs of advanced alcoholism. He was asked if he had taken gas before, and he said that he had on one occasion and when he awoke he had walked the chair across the operating room and was gripping the doctor in one hand and the nurse in the other. He was given 20 grains of chloretone, and, after an hour, responded to anesthesia in the usual manner and presented a fair anesthesia margin and was carried into quiet anesthesia while the teeth were removed. In either of these cases, we could have given 100 per cent nitrous oxid to the patient and, with the aid of the concomitant asphyxia produced, have carried him into a state of anesthesia under which the operations could have been done, at least without the patient's knowledge; but few would have the disregard for these patients to produce the necessary degree of asphyxiation or would have the attendants necessary to restrain them. Such a procedure is wrong, because it is dangerous. Shall we, as anesthetists and surgeons, jeopardize the safety and welfare of our patients merely to promote our own personal aggrandizement before our audience? Or for the selfish personal satisfaction of saying "I can do it." Or shall we, with honest conservatism, fulfil our obligation to our patients and justify their confidence in us by protecting them as we would want our own safety protected? Dr. McKeeson says that in known difficult subjects, a No. 1 hyoscin-morphin-cactin tablet dissolved under the tongue about forty-five minutes is a great aid for those whose technic or equipment is defective, but that any patient may be anesthetized without morphin or narcotics. There are many nitrous oxid anesthetists yet in the making and a recommendation that dentists anesthetize all of their patients with nitrous oxid-oxygen, and without premedication, would probably result in many discouragements and failures, and possibly some serious accident. Dr. McKesson contends that, in dentistry, premedication with morphin or chloretone causes more nausea and a prolonged recovery period, hence a delay in the patient's leaving the office. Chloretone is a local anesthetic, and, to some degree, anesthetizes the stomach lining, rendering it less sensitive and lessening the chance of nausea. Even were this not the case, the chances of nausea and depression would be greater from asphyxial anesthesia stages necessary to control the more resistant patients than from the use of morphin or chloretone. Furthermore, it sometimes happens that patients come unprepared, with the stomach full of undigested food, and nausea develops. If vomiting begins, the patient should be allowed to awaken until vomiting ceases, otherwise the vomitus may be aspirated into the trachea and obstruct the air passages. Usually, if such patients are reanesthetized, there is recurrence of nausea, and, frequently, vomiting before anesthesia stages are reached, and if they are forced into anesthesia, unusual depression follows, often accompanied by prolonged nausea and severe headaches. I believe that, when there is any vomiting, it is good practice to discontinue the gas and complete the operation with local anesthesia, when it is possible, as is usually the case. It is highly desirable to both patient and operator that the operation be performed or completed rather than that its completion be delayed until another day. There are patients who have a decided antipathy to losing consciousness. Some positively refuse to take a general anesthetic. With no conditions especially contraindicating the use of local anesthesia, the patient's preference should receive due consideration. Also, the exodontist is called on to perform some most difficult operations in locations difficult of access and vision, and the advantages, from the operative standpoint, of a bloodless field and a patient's cooperation more than offset any slight disadvantages there may be to the use of local anesthesia. I have not found that the disadvantages of local anesthesia here enumerated are of a degree sufficient to be of material consequence, or to be prohibitive of its use when indicated. Doubtless the reasons given by Dr. McKesson may account in some instances for divided extractions, but there are good and sufficient reasons why teeth are and should be extracted serially. It has come to be quite generally the opinion of physicians that the removal at one time of many pulpless and infected teeth is hazardous, especially to patients in whom it seems that infection is being absorbed into the general system. It is also claimed that, with each inoculation, owing to this absorption the patient's resistance is increased and the result is analogous to that of autogenous vaccination. The oftener repeated, the greater the assistance to the patient. However, this may be, in some localities at least, the dentist who disregards these matters invites severe criticism from the

medical profession and also from the public, who are becoming surprisingly enlightened on the subject of mouth infections. In the removal of such teeth and the curreting, any defenses Nature may have organized against foci of infection are destroyed and new avenues are opened for entrance of infection into the blood stream. So there is a possibility that the patient may not have resistance with which successfully to combat this increased absorption. Naturally, the greater the number of infected teeth removed, the greater this possibility.

From the wording of the questionnaire as indicated by the replies to questions as to technic of anesthetizing, Dr. McKesson would have you believe that someone has advocated a technic of administering a definite anesthetic mixture for a fixed time without regard for symptoms. If anyone advocates such a procedure, I am not aware of it. Since Dr. McKesson has on other occasions referred to such a technic perhaps he can enlighten us. If he refers to the use of timing (as practiced and advocated by me) as a means of uniformly administering the gases, and as an aid in anesthesia induction, for those who are not informed or may be or have been misled, I would say that always in describing this technic I have clearly stated that symptoms are at all times to be observed and that anesthesia stages are judged by them.

Arthur E. Smith, Los Angeles, Calif.: I have always admired the operator who, after due consideration, in the examination of patients, will use nitrous oxid, or ether, or whatever the anesthetic may be that seems to be indicated in that particular case. I cannot help rising at this time in defense of local anesthesia. In the experience I have had in block work with nitrous-oxid oxygen, the results were not similar to those of Dr. McKesson. A local anesthetic, when administered properly, into a nerve trunk at the point distal from operation will not produce after-pain. When procain is dissolved in a solution which conforms to the tissue cells, there is no reason why it should produce postoperative pain. I have particular reference to infiltration; of which I am not an advocate. In regard to the reports sent back by the operators, I believe that many of these are based upon infiltration anesthesia, not the deep block. Postoperative pain, in my mind, has been caused more times by infiltration than the deep block. It has produced anoxemia; whereas, if the deep injection is done at a point distal, in the region of the nerve trunk, it does not produce ballotting of the tissues, which, no doubt, are already infected. As to the removal of a number of teeth, I might have misunderstood Dr. McKesson. I hope that I did. I understood him to say that it was not possible to remove so many teeth, or, in other words, you are restricted as to the operation under block anesthesia. That has not been my experience, and I think the experiences of many of you have been at variance. It is possible to remove all the teeth in the upper and the lower jaw. I don't know what more we want. That doesn't require very much local anesthetic, but if infiltration is used and there are all the individual injections, a larger quantity of solution must be injected.

W. I. Jones, Columbus, Ohio: Six years ago, at a meeting of the Interstate Association of Anesthetists in Cincinnati, I made the statement that, in my opinion, anesthesia is a deoxygenating process. Five years later, after performing a great many animal experimentations in the physiologic laboratory of the Ohio State University, I read a paper before the Associated Anesthetists of the United States and Canada at Chicago, in which was emphasized the statement that anesthesia is a deoxygenating process and that the anesthetic agents such as ether, nitrous oxid and ethylene, unite with hemoglobin in the blood, by crowding out the oxygen, forming loose molecular compounds (not chemical ones), from which they (the anesthetic agents) are dissociated by the inhalation of air or oxygen. Chloroform is more lethal because it breaks up in the blood stream into its original elements and forms toxic compounds. Some of the evidences substantiating this opinion are: 1. Irritability of nerve and brain cells depends upon the presence of oxygen. 2. Loss of irritability (anesthesia) accompanies lack of oxygen. 3. Oxygen is the chief and best antidote for anesthesia. These facts have been determined by laboratory experiments and clinical practice.

Dr. McKesson places more confidence in the forcible expansion of the lungs by oxygen for the purpose of resuscitation than I do.

To resuscitate a patient, the normal respiratory movements must be reestablished, and that is best accomplished by artificial respiration. Any one of the several well known methods that produces a rhythmic elevation

and depression of the chest wall, which forces air out of the lungs as well as into the lungs at regular intervals of three or four seconds will suffice. The efficacy of this procedure may be augmented by holding a mask over the mouth and nose and administering under slight pressure, oxygen mixed with 5 per cent carbon dioxid, care being taken that the air passages are clear. Carbon dioxid is used because it is the normal stimulant of the respiratory apparatus. The main fact that I want to impress upon my hearers is that it is not only necessary to inflate the lungs, but also they must be deflated as well and any method or apparatus that is capable only of forcing oxygen into the lungs must be assisted by some artificial respiration in emptying the lungs. A pulmotor would be of no value if it did not empty the lungs as well as fill them.

Frank W. Chandler, Hollywood, Calif.: I cannot agree with Dr. Smith in regard to the subject of procain, nor its action. Any practitioner using procain for a long enough period knows that in certain individuals it is a metabolic poison, and will in some persons produce unpleasant reactions. I thoroughly agree with Dr. McKesson that nitrous oxid and its concomitants can be given under nearly all circumstances, if administered by skilled and competent anesthetists, always bearing in mind the physical condition of the patient. No one has yet solved the selective action of anesthetics on the nervous system, and why it does not interfere with vital functions. All admit a susceptibility of certain nerve tissue, but none explain it. Just what does produce anesthesia—why and how? There are only two general classes for which I do not like, personally, to assume the risk. Those having myocarditis and high blood pressure, and renal diseases. As to ethylene, I am just as afraid of ethylene as I am of secondary saturation; and the principal use we have in California for ethylene is the bleaching of oranges and lemons. Its use, manufacture and storage is prohibited in Portland, Ore. We know it to be a dangerous explosive. We all know that nitrous oxid has been tried, proven and found to be true, and will do the work sufficiently well, in competent hands, to indicate its continued use, and should not change to one of questionable merit, not tried nor proven. I want to congratulate Dr. McKesson on his scientific attainment in the field of anesthetics; on his willingness ever to serve the dental profession, and for his contribution in the field of general and special anesthetics. His attainments merit our respect and lasting gratitude.

J. Franklin Moore, Oakland, Calif.: In regard to the statement of Dr. Chandler that only one death was due to an anesthetic in California, which was due to procain, I know of at least three cases around the Central Bay District in which death was due to nitrous oxid-oxygen anesthesia.

Dr. McKesson (closing): Any paper must be a compromise between the time allotted and the subject matter to be presented, and that oftentimes leads to misinterpretation of what was really said or intended to be said. I did not discuss secondary saturation in this paper, but referred only to the signs of deep anesthesia, which are only a part of the symptom complex of secondary saturation. I have not changed my opinion regarding secondary saturation since describing it in Pittsburgh. There are two methods of producing secondary saturation—a slow method and a rapid method. If we give a patient the proper mixture of nitrous oxid-oxygen to produce anesthesia and continue that mixture for half an hour or three-quarters of an hour, or perhaps longer, we ultimately get secondary saturation. The rapid method to produce secondary saturation is by giving *less than* the required amount of oxygen and, arbitrarily, intentionally to bring on the symptom complex of deep narcosis; then add oxygen sufficient to clear up the signs of deep narcosis, and secondary saturation is accomplished. Every man here who has given nitrous oxid-oxygen successfully for any considerable period or in a large number of cases has produced secondary saturation in a great many cases, whether he wanted to or not, it being accidental. I found, through accident, that a patient who had been deeply anesthetized, and then given not too much oxygen immediately after, was in better condition as regards anesthesia than he had been before. The margin of anesthesia is increased by hypnotics. I hope I did not leave the impression that we should not use hypnotics. I use them all the time except in dental cases. I did say that a hyoscin-morphin-cactin tablet, under the tongue, was one of the things that one could give a patient. Hypnotics increase the margin between deep anesthesia and light anesthesia, and I think it accomplishes the same thing that Dr. Jones has suggested; i. e., the narcotic diminishes

the oxygen supply to the cells, just as nitrous oxid, or any other anesthetic with which I am familiar, produces anesthesia. With regard to extraction, I believe that drainage by extraction is a surgical principle. There should be as free drainage of an abscess here as in any other location of the body. If we have two mastoids involved in a case, and we operate on but one side, we invite thrombosis of the lateral sinus if we fail to operate on the other side also. Suppose two teeth have the same infection and one is extracted and the other left. To me, this seems similar to operating on one mastoid and leaving the other, thereby causing the latter to become more acutely infected and so more dangerous. I had intended to show that nitrous oxid may be administered to all patients, and I still maintain that. If the patient is difficult to handle, give him a little morphin, chloretone or some other hypnotic. Local anesthesia probably produces much postoperative pain and tenderness. Whether it is due to a prolonged effect of anoxemia may not be manifested by the capillaries and blood vessels, but from chemical action. Dr. Jones brought up a subject that we could discuss, regarding the use of oxygen to resusciate the patient. He has in mind a mixture of oxygen and carbon dioxid as a stimulant to respiration. Now, what we should do in resuscitation of a patient is to maintain his life processes by the administration of oxygen, until out of this oxygen administered, he produces or manufactures the carbon dioxid by which to stimulate his own respiratory center. If it is properly done, and the anesthetist is sure that he is getting oxygen into the blood stream, which can readily be determined by the retraction of the pupils, then he can be absolutely sure that the patient will manufacture the carbon dioxid out of that oxygen and will start breathing if there is circulation. Dr. Chandler suggested the danger of myocarditis. That is a possibility, because in myocarditis the heart may stop first, if the anesthetic is pushed too far. But the danger is remote. Myocarditis or myocardial degeneration is one of the most dangerous things we have to deal with, and it doesn't matter whether we give the patient a local, a general or no anesthetic at all, he is liable to die. He may die some time from that condition, and may die in your office, as happened in one of our dental offices in Toledo. The surgeon was not present in the room. The nurse put the patient into the chair. When the surgeon walked in, the patient had already died. He had not anesthetized him, fortunately. But this same patient had been successfully anesthetized several weeks before with nitrous oxid-oxygen for extraction.

GENERAL CONSIDERATION OF OCCLUSION AND THE MONSON THEORY*

By A. WOLFSON, D.D.S., East Orange, New Jersey

THE subject of occlusion and articulation, and, perhaps more popularly, so-called anatomic articulation, at the present moment holds the center of the stage in dentistry. One cannot open a journal or attend a meeting or a convention without hearing such terms as anatomic articulation, traumatic occlusion, balanced occlusion, compensating curves, condylar inclinations and paths, and other confusing and over-worked terms, supposedly scientific, until one is absolutely lost in the barrage raised by the various advocates of ingenious anatomic articulators on the market today.

I feel deeply for the younger men in our profession, who, with minds unprejudiced wish to learn something about this apparently fascinating phase of our work, but yet are at a loss as to where to turn to find the truth. Shall they apply to Gysi and Hanau and Chappelle or to Hall, Needles, Wadsworth and Monson? I have written this paper with the sole purpose of extending a helping hand to the young men who have the future to face and who wish to embark on the right path.

Let us, therefore, for the purpose of simplifying the subject matter, concern ourselves for the present only with the problems arising in full denture work. Considerable time could be spent in a review of the early attempts in this field of restorative work, and yet such history is significant to the keen scholar of technic rather than to the average worker who is seeking the latest advance. Suffice it to say that organized effort in full denture restorations dates back about 125 years, presenting a gradual evolution from the plane line articulator to the type that all of us used in our college days, in which a certain amount of movement in either the upper or lower arm is permitted, with a view to simulating, in a measure, the so-called mandibular movements. In the last few years, many articulators have been placed on the market, which, according to their respective inventors, could not only simulate some of the movements of the mandible, but could actually reproduce all of these movements. Yet, as we look back over this gradual progressive evolution of modern devices, we cannot but feel that the basic thought involved in every one of these has been identical; namely, the ability to produce in the mechanical device mandibular movements as they occur in the living subject. It is true that, in each later model, a greater degree of perfection and mechanical ingenuity has been accomplished until this series of endeavors has finally culminated in a device produced by Mr. Hanau, in Buf-

*Read before the Clinical Club, Newark, N. J., March 30, 1925.

falo, which, for purposes of discussion, we may consider representative of the best efforts in that particular field.

Needless to say, in each introduction of a new slot or a new screw or a new joint, a new term, a newly coined word, and perhaps a new definition, are also presented to the profession until this desire for elaboration culminates in such presentations as a recent article on dental engineering.[1] In this article, which treats under subhead occlusion

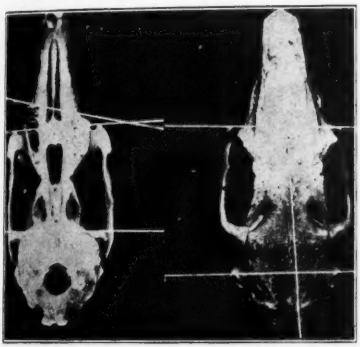

Fig. 1.—Upper portion of skull of sheep in which occlusion on one side was interfered with; showing resultant assymetric development. (From experiments of Dr. Baker.)

relations and articulations, defined, discussed, registered and established, the author presents a host of new definitions. It would be an imposition if I were to cite all of these, but permit me to read a few of these new terms which the author introduces into dentistry:

Unbalanced occlusion
Strained and unstrained occlusion
Center occlusion of the masticatory surfaces
Protrusive occlusion of the masticatory surfaces
Retrusive occlusion of the masticatory surfaces

1. Hanau, Rudolph: Dental Engineering Dent. Items Int., March, 1924.

Right lateral occlusion of the masticatory surfaces
Left lateral and intermediate
Rest relations of the mandible to the maxillae
Ordinary relations of the mandible to the maxillae
Balanced relations of the mandible to the maxillae

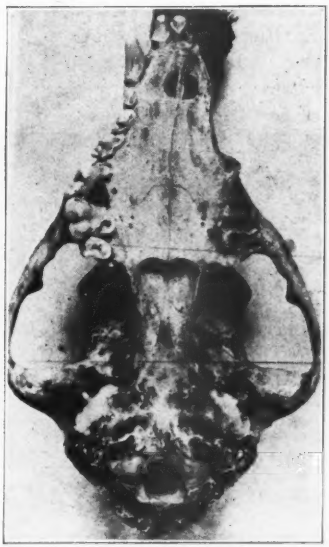

Fig. 2.—Portion of a skull of a dog. This and the portions of skull shown in Figures 3 and 4 were subjected to experiments similar to that referred to in Figure 1.

Unbalanced relations of the mandible to the maxillae
Strained relations
Unstrained relations
Rest relations
Centric relations
Protrusive relations
Left lateral relations
Intermediate relations
Articulations
Anatomical relations
Prosthetic articulations
Natural articulations
Mal articulations

Balanced articulations
Unbalanced articulations
Semi-prosthetic articulations
Mixed articulations

To say nothing of a few illuminating definitions such as: "intimacy of contact closing surfaces;" "seating surfaces;" "supporting surfaces," and articulation and kinoscope.

Mr. Hanau represents the highest type of intellectual development in one humble phase of our profession, but if the citation of these new terms should

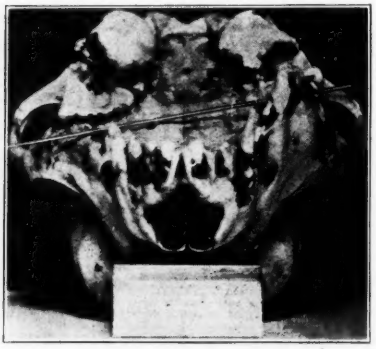

Fig. 3.—Portion of dog's skull.

tend to discourage anyone here from any further endeavor in this work, let me reassure you with a frank confession that most of these definitions are just as meaningless and just as useless to me as they seem to be to you.

For a few years, perhaps twenty or thirty, men in the dental profession who have dared to do original thinking without fear of excommunication have been looking about them for more light on the subject of occlusion in perhaps other fields than that strictly of restorations in the human subject. Some dared to approach the problem by starting at the bottom of the ladder and trying to understand the basic problems involved. What are the data given and what is it that we are attempting to do? We are given, fundamentally, two bones: the upper maxilla and the remainder of the skull considered as one bone, and the mandible as another. A definite physical relationship exists between these two bones. That relationship, more intimately considered, appears to be maintained by projections from each of these two bones, namely, the teeth, interlocking in all animals in a definite relationship.

The constancy of that definite relationship has been one of the first

Fig. 4.—Portion of dog's skull.

revolutionary thoughts injected into our problem of restorations. Examinations of skulls of whatever race and in whatever part of the world show that, if those skulls appear normally developed, they reveal a definite orderly relationship between the teeth of the upper jaw and the teeth of the lower jaw. Many investigators became aware of this constancy of relationship of teeth, but not until Dr. Angle defined normal occlusion and pointed out the constant relation that exists between the upper first molar and the lower first molar did men concentrate on the subject of tooth arrangement. From then on, there arose the question of the influence that this tooth relation exerts on the jaws and other related parts. At this stage,

the profession was faced with two major problems; the temporomandibular articulation and condylar paths, a series of pictures of dogs that were experimented on by Dr. Baker, of Boston, in which he deliberately interfered

Fig. 5.—Skull of alligator with a concave condyle and prominence in place of glenoid fossa; illustrating adaptation of form to function. (The alligator, in opening the mouth, raises the upper jaw rather than depressing the lower, as does man.)

and this newly recognized tooth relationship, which I shall refer to as occlusion, for the sake of simplicity. Which, then, is to be considered the master of the situation? With the true

Fig. 6.—Right side of skull, showing normal position of head condyle.

spirit of scientists, experimentation was resorted to in the hope of altering some of the given constant factors and thereby studying the effects produced.

The accompanying illustrations show with the normal occlusion and was able to obtain some very startling results in the rest of the head. In other fields of endeavor, such as comparative

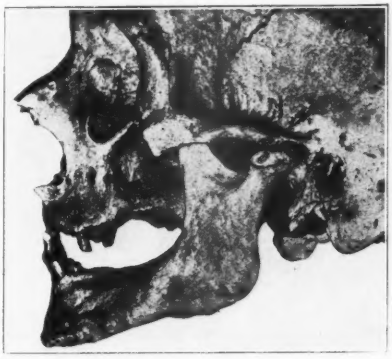

Fig. 7.—Left side of skull shown in Figure 6. The condyle is in a forward position because of an attempt to bring the jaw forward, making a lower posterior tooth occlude with an upper anterior. (Cryer.)

anatomy, this problem was also investigated. I quote from Dewey's book on

comparative dental anatomy, in which he considers the evolution of the temporomandibular articulation:

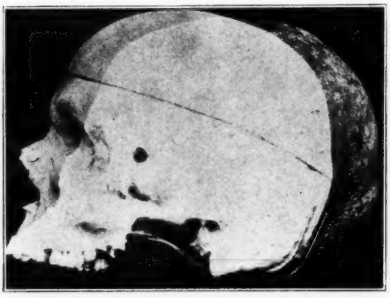

Fig. 8.—Composite view of left and right sides of skull shown in Figures 6 and 7. The marked differences in development of the entire skull is a result of difference in function between the two sides. (Cryer.)

With the evolution of the tooth forms and the occlusion of the teeth we notice a corresponding change in the jaw forms and the temporo-mandibular articulation. In those animals which have occlusion of tooth-bearing surfaces, the temporo-mandibular ar-

Fig. 9.—Left: Normal skull containing full complement of teeth. Right: edentulous skull; showing difference in anteroposterior relations of upper and lower jaws, due to absorption of external alveolar plate of maxillary bone and internal mandibular plate. (Cryer.)

ticulation is very loosely constructed and the condyle and glenoid fossa have very little shape. In those animals which have occlusion of rows of teeth, there is more of a condyle and glenoid fossa. In the alligators, owing to the anatomical structure of the animal, we find that the condyle is concave and the

Fig. 10.—Under surface of skull (Fig. 9); illustrating difference in anteroposterior relations.

glenoid fossa convex and the mandible is the more stationary bone when the mouth is opened. In those animals with occlusion of the cusps, we find the articulation influenced by the shape of the cusp. In the animals which have long cusps, the glenoid fossa is decidedly concave, and in those in which the

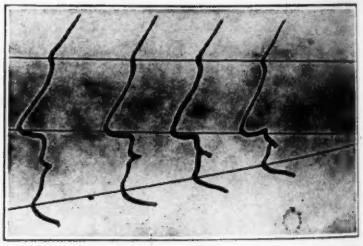

Fig. 11.—Changes occurring in the lower third dimension of the face when an edentulous patient attempts to occlude the upper and lower ridges by forcing the mandible posteriorly.

cusp is short the glenoid fossa is only slightly concave and often entirely flat. When we find the cusps of the teeth so arranged that the tooth has a long antero-posterior diameter the condyle has a great bucco-lingual diam-

eter. The greatest diameter of the tooth is always the opposite to the greatest diameter of the condyle. In man, we find that the shape of the condyle changes as the occlusion changes. In fact, in young animals of whatever family, the temporomandibular articulation does not assume a definite shape until after the teeth are in occlusion.

These few facts, as well as a host of other facts in various lines of research recently conducted, tend more and more to prove definitely that the

Fig. 12.—Method of testing condyle encroachment as result of posterior drift of the mandible.

key note of our problem in dentistry and particularly in the field of restorative work, such as that of full dentures, is not the temporomandibular articulation and its complicated mechanism, but rather the problem of occlusion of the teeth.

I have pointed out two schools of opinion on this problem. On the one hand, we have men who proclaim the accurate reproduction of temporomandibular movements as being essential to successful prosthetic constructions, and, on the other hand, we have men who pay no attention whatever to the temporomandibular articulation, or, at least, no attention within reasonable limits but rather uphold the occlusion as the master of the situation. It is my opinion that all signs of any scientific value point to the latter evidence.

Exactly what is being done today to develop this thought? For systematic and intelligent consideration of the problem of occlusion, we must turn to the orthodontist. Dr. Angle, an orthodontist, first pointed out the constancy of relationship between upper first molar and lower first molar. Dr. Martin Dewey, an orthodontist, established the dependence of the temporomandibular articulation on the occlusion by his research work in comparative dental anatomy, and Dr. George S. Monson, at that time an orthodontist, gave us the spherical theory of occlusion. It would be of considerable profit to us to be at least slightly familiar with what is being done in the orthodontic world in the study of occlusion. I shall at this time make only scant reference to some of the men now actively engaged in advancing our knowledge of occlusion and shall amplify my remarks later. We have such men as Halley, Gilpatric and Stanton, each endeavoring to wrest from Nature a knowledge of any laws that she may have for the harmonious, efficient or satisfactory alinement of the teeth of one jaw as related to the teeth of the other. More recently, we see attempts made to study tooth arrangement in its relation to the rest of the face and cranium, and in this field I shall be able to demonstrate work done by Professor Simon, of Berlin, and some of my own original work, which is being done at the present time at the Dewey School of Orthodontia.

With appreciation of the things that I have so far pointed out, we are able

to cope more intelligently with the Monson theory of occlusion, which has aroused such keen interest and discussion in the last four or five years. Simply stated, the Monson spherical theory of occlusion holds that, in all skulls of the white race, in the highest type of development and when no pathologic factors have interfered, the teeth of the lower jaw are so arranged in the arch as to be tangent to a sphere approximately 4 inches in radius, which, by corollary, implies that the inclinations of the teeth are such that, if the long axis of each tooth was prolonged, all axes would converge to a common center, the center of the 4 inch sphere.

This and nothing more is the Monson theory of spherical occlusion; but if I were to cease at this moment, there might be dissatisfaction because I failed to touch on the radiating influences of this theory. Let us briefly visualize the phenomena that we have all observed in many patients so that we may arrive at the conclusions which Dr. Monson reached in his observations. We are all cognizant of the consequences of the nonreplacement of a tooth that has been extracted. Let us suppose that the two lower first molars were removed, and I need but hastily refer to the usual phenomenon of the drifting of the bicuspids and the anterior teeth backward and a lower drifting of the second and third molars, with a further loss of tooth substance. The relationship of the maxilla and the mandible

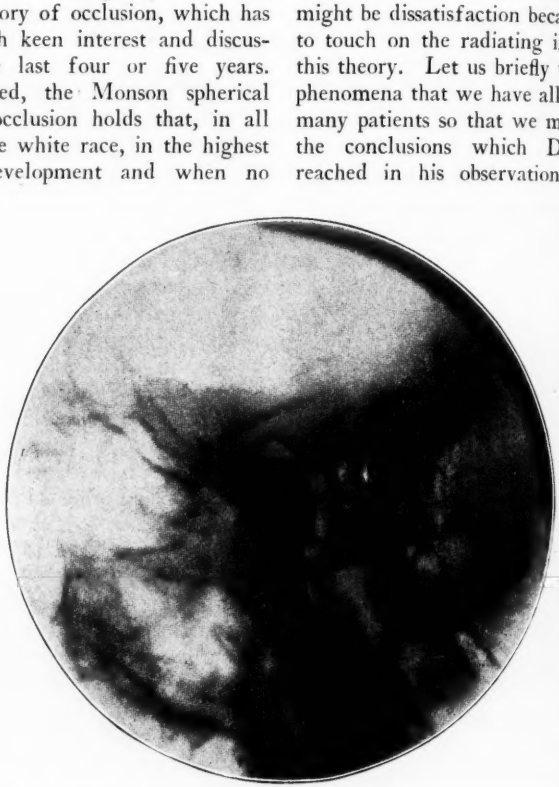

Fig. 13.—Temporomandibular articulation. The roentgenogram is especially valuable in a differential diagnosis between a mandible that drifted posteriorly and a micromandibular development with normal interarticular space.

alters gradually but surely, the tendency being to bring these two bones closer to each other, or, as we term it, the lower third dimension of the face diminishes. As this lower third diminishes and the so-called bite closes, the entire mandible slips back and the head of the condyle is disturbed as regards its normal relation to the glenoid fossas and gradually slides back.

Fig. 14.—Simon's method of taking an impression of the upper teeth and at the same time recording landmarks on the face as points determining Frankfort and orbital planes.

Enthusiastic supporters of the Monson theory, particularly in the West, have reported observing this backward slide of the head of the condyle until it actually impinged upon and perforated the interarticular fibrocartilage. I have particularly in mind a report made in 1918 by Dr. Prentiss, professor of anatomy of the University of Iowa, in which he states that he has observed similar cases in a dissecting room in which the meniscus was perforated, which he attributes to the fact that the type of occlusion was such as to produce this injury. Other enthusiasts have gone even further, reporting cases in which the head of the condyle, after perforating the meniscus, encroaches directly on the outer wall of the ear and produces partial deafness. This line of reasoning to me appears slightly hazardous and unquestionably far-

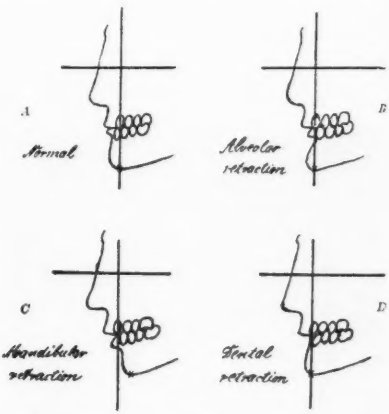

Fig. 15.—Simon's classification of profiles as related to Frankfort and orbital planes.

fetched. I offer this criticism, with all due respect to the voluminous work done by Dr. Monson, and in a friendly spirit, hoping to hold in check thereby enthusiasts who, by their excessive zeal, tend to invite ridicule rather than endorsement.

Dr. Connors,[2] of Michigan, who undertook to verify the work of Dr. Prentiss, concluded that, while there might be perforations, these could best be explained on the grounds of inflam-

2. Conners, M. C.: Dent. Cosmos, 67: 124 (Feb.) 1925.

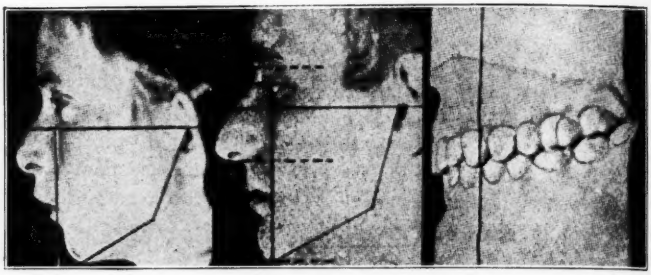

Fig. 16.—Simon's classification of malocclusion from photostatic photographs.

matory processes and congenital defects. Dr. Connors states further that, in his opinion, Dr. Prentiss had not sufficient anatomic evidence to bear out his contention.

In an effort to investigate further the partial deafness theory, I talked with an otologist regarding the theories above mentioned. It was his opinion that, because of the rather distinct an-

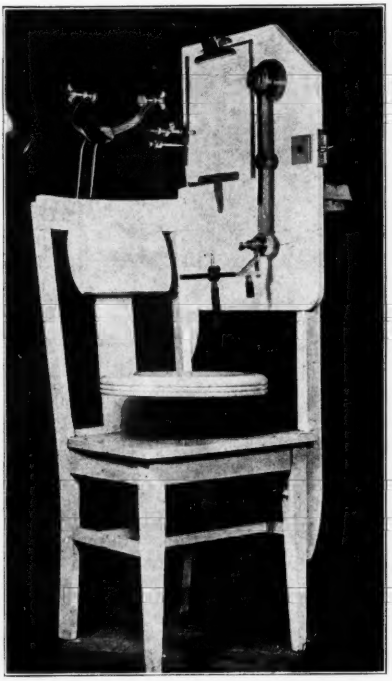

Fig. 17.—Profilograph: A device for recording the actual profile as well as any selected points on the face and cranium, and positions of the teeth.

Fig. 18.—Profilograph in operation.

atomic separation between the temporomandibular articulation and the ear proper, there could hardly be a direct connection between the backward slide or thrust of the condyle and deafness, whether partial or total. It is interesting in this connection to know that, no matter how large the mechanical obstruction of the ear canal may be, and whether due to growths, wax, inflammatory processes, or condylar impingement, deafness will not be produced to any appreciable extent, provided there remains even the slightest opening.

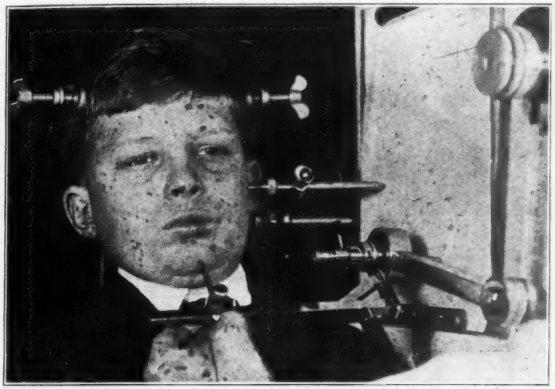

Fig. 19.—Close view of mechanism of profilograph.

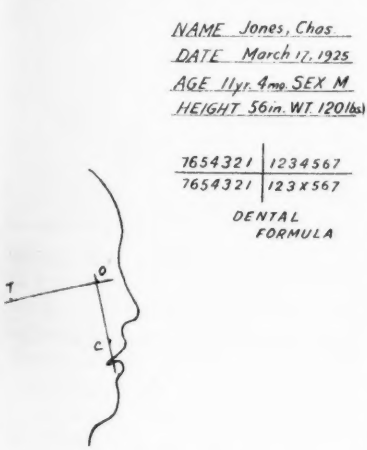

Fig. 20.—Dentofaciocranial map made with profilograph.

In order, therefore, to be able to substantiate any such claims as partial or total deafness associated with a backward position of the condyle, it would be necessary to prove by either dissecting room data or roentgenographic evidence that the ear canal has become completely closed. I have tried at various times to adapt roentgenographic examination of the temporomandibular articulation to the explanation of whatever phenomenon might occur in this joint due to alterations in the occlusion. On careful inquiry of various men who I know are interested in this work, I found that no one was taking roentgenograms of the temporomandibular articulation, the excuse in several instances being that it is too difficult to obtain a satisfactory picture. This did not seem altogether plausible, and I finally found

some excellent roentgenograms[3] in which almost without exception, and though they were not even directed at the joint, the temporomandibular articulation, and particularly the head of the condyle, stands out clearly.

I conferred with Dr. Law recently, and he was much interested in the possibilities of developing a technic in which it would be possible to aim at the joint and undoubtedly to succeed in getting a clear picture without superimposing shadows. We have made a tentative arrangement for research along this line and hope to be able to publish results both as to evidence obtained and the technic used for obtaining correct positions.

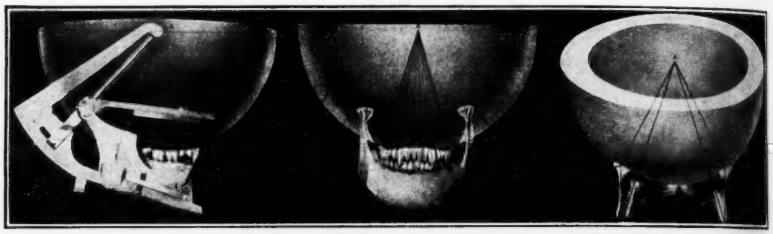

Fig. 21.—Graphic illustration of Monson's theory of spherical occlusion.

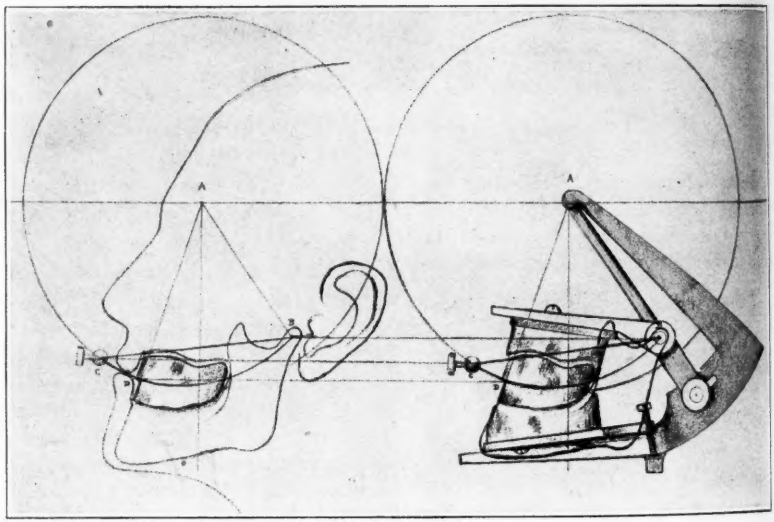

Fig. 22.—Monson's chart, showing a parallelism between the position in the skull and duplicating casts on the instrument.

3. In Law, F. M.: Annals of Roentgenology, Vol. 1: Mastoids Roentgenologically Considered, New York, Paul B. Hoeber, 1920.

Before leaving this phase of the subject, let us consider the significance of such roentgenograms. If it is true that the mandible slips back bodily, with a train of sequences in the joint, it is undeniably desirable, in our restorative work, by one means or another, to bring the mandible forward again. We have another type of case brought to us for restorative work, in which the mandible

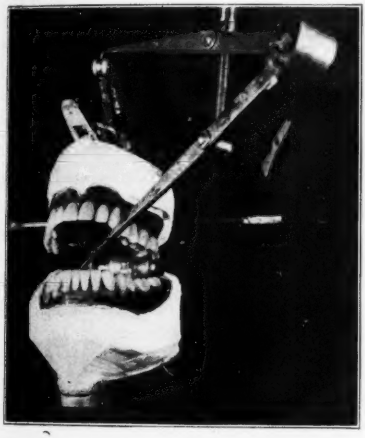

Fig. 23.—Artificial teeth arranged on Monson instrument.

appears to be in a posterior position, and which may be a case of micromandibular development; in other words, a case of underdeveloped lower jaw in which the head of the condyle may be, and even is, at the time when we see the case, in a normal position in the glenoid fossa. It would be erroneous to attempt, in a case of this type, to bring the mandible forward to any such degree by mechanical restorative means, as we would in the first type. Right here, then, our roentgenography of the joint would produce a reliable differential diagnosis.

CONCLUSION AND SUMMARY

In summarizing the practical value of the Monson spherical theory in work of restorations of all types, as well as its diagnostic value in periodontia, let us clearly keep in mind this one definite fact. This theory claims a spherical arrangement for teeth in skulls of the white race of the highest type of development. Both race and high type of development are two mooted questions in anthropology. There is really no such thing as a purebred race, and it is almost equally safe to say that there is no such thing in our daily life as examples of the highest type of development. So-called original races of men have become blended by interbreeding until it is well nigh impossible to draw fine lines of distinction, and as for the highest types of development, we must in this connection take into consideration external influences that tend to affect what might have been originally predestined to be a high type of development. Tersely stated, function influences form and use, both normal and abnormal, including overuse and lack of use, whether symmetrical or assymmetrical, and has its resultant changes in the form. If, therefore, we are presented with a case in which only a few teeth have been lost, and it is our plan to restore these lost members by means of a bridge, we could not very well take for granted that, prior to the loss of these teeth, this particular skull was of the white race purely, of the highest type of development and uninfluenced by such external forces as excessive use of one side over the other. It would, therefore, be fallacious to attempt to restore such a mouth arbitrarily to a spherical tooth arrangement.

To me, therefore, the sphecial theory is of no practical value in this type of

restorative work. In the field of partial dentures, we need stop only a moment to say that, in the degree in which a partial denture simulates a full denture, the theory is valuable, but when a considerable number of natural teeth remain and the case resembles the type described for a bridge restoration, the theory is again of no avail. And similarly in the field of periodontia and orthodontia: In Periodontia, when casts are made for the detection of traumatic occlusion that can be more graphically described as cusp interference, we are justified in studying on the Monson instrument only those few cases that were at one time, or would be at the present time, in spherical arrangement had it not been for the one and sole disturbing factor that produced the cusp interference. If, for example, we were dealing with a patient belonging to a race in which the plane of occlusion under normal conditions was almost flat, and this patient were to develop cusp interference, resulting in periodontoclasia, it would be ridiculous, to my mind, to demand that all of these teeth be brought to a spherical plane. And, finally, in the realm of orthodontic treatment: As I understand it, the purpose of orthodontic treatment is to bring the disarranged teeth of the two jaws into the ideal arrangement intended by Nature for that particular skull if no interfering influences entered to produce a deformity. Now then, if that ideal arrangement intended by Nature should happen to be a type of arrangement in which the plane of occlusion was other than spherical and yet the *tout ensemble* produced normal occlusion as we vaguely understand it today, it would be gross meddling to try to bring such teeth arbitrarily to a spherical arrangement.

My conception, therefore, of the utilitarian value of the Monson spherical theory is its universal application in full denture prosthesis only. In this type of work, as I have previously pointed out, the occlusion becomes master of the situation and also when we are given only seating areas for our dentures and nothing more, we, in turn, become the masters of the entire situation, and therefore can arrange our teeth either spherically or in any other form we please. I choose to arrange them spherically because the spherical theory closely approximates conditions in Nature and is mechanically feasible, and the technic is so simple that it takes little more time than careful execution on a plane line articulator.

Let us, therefore, adhere to the Monson spherical theory of occlusion in our full denture work but let us not fail to be cognizant of its scientific short comings, its arbitrariness and its limitations; and let us follow it until such time as we have something more definite or more flexible or more scientific.

REVIEW OF THE LITERATURE REGARDING INFECTED TEETH*

By THOMAS B. HARTZELL, M.D., D.M.D., Minneapolis, Minnesota

YOU have done me the honor to ask me to review and analyze the evidence now existing regarding pulpless and infected teeth. This honor I appreciate and I will proceed with this task in as orderly a fashion as I can.

First, allow me to state, however, that the premise involves *all* teeth, both vital and pulpless; for they all support bacterial growth, and in that sense are infected; some on their surfaces only, others within the structure of the tooth, if pulpless, while the pulps of many vital teeth may, and often do, contain growing bacteria.

If we admit the truth of my premise and accept the belief of the radicals who say that the streptococcus cannot be conquered, and therefore all infected teeth must be extracted, dentistry as now constituted must perish. Its place will be taken by the services of the exodontist and the commercial laboratory, and artificial teeth will replace the natural organs. Friendly assistance will be given by the tooth manufacturers.

But why accept this radical leadership and deny the possibility of controlling the growth of streptococci in and about human teeth, when we now can *demonstrate* successful mastery of this problem on the part of a few who can become teachers of the many, if they will but believe and work?

Let us, therefore, examine the publications that have mostly influenced the dental mind in reaching its present opinions, and to determine whether we are being led aright, let us ask ourselves if we are making correct conclusions from the evidence at hand. It will be impossible to cover the whole of the literature, but I shall try to select those publications and lectures that have reached the greatest numbers of men and have most influenced thought.

Of the men in the United States who have influenced dental thought with regard to infected teeth, Price, of Cleveland, stands preeminently first because he has induced more men blindly to accept his teachings without analysis, than has any other one man. Although not a physician, he speaks with authority on bacteriology, immunology, physiologic chemistry, pathology and physiology, and many other specialties in the field of medicine, so I shall touch on some of the several matters pertaining to these various subjects throughout my paper, rather than make a critical review of his whole work at this point.

Following him, and as next in importance, we will consider the work of Edward C. Rosenow, who has been

*Read before the Chicago Dental Society, Dec. 15, 1925.

quoted by Dr. Price, and the inspiration of whose work seems evident in Price's publications from beginning to end. Rosenow's work on dental infection was commenced about the end of 1913 or the beginning of 1914. In a personal communication, after I had visited him at the Research Institute for Infectious Diseases in Chicago, in the fall of 1913, he told me that he had paid little attention to the teeth; that he had paid more attention to streptococcal infections in other parts of the body. And, as I was interested particularly in infections arising in and about the teeth, and desired to interest him in them also, I presented him with a series of thin pyorrhea instruments for recovering pus from deep pyorrhea pockets. He was kind enough at that time to give me some advice regarding the problem I was then to undertake of investigating tooth infection. Rosenow's articles on the problem of infection, and on dental infection particularly, number fifteen or twenty. The underlying idea most stressed by him is the alleged power of bacteria to select the tissues of the body in which they will locate themselves. This he designates elective localization. This idea has not been accepted by the bacteriologists of the country as a class, because they have not been able to secure the results secured by Rosenow. He has, however, an ardent supporter in Price, whose accomplishments in the field of research in this line far exceed those of Rosenow. Dr. Russell L. Hayden has published some work which seems to support the theories of Rosenow. With the exception of these two instances, the belief that bacteria have the power to localize themselves in certain tissues *exclusively*, or in any marked degree, and to leave the balance of the tissues of the body uninvaded, has gained little headway, and the theory is not generally accepted. Rosenow's thought has influenced the dental profession wherever his papers have been read or published; but in justice to him, it should be said that he has made no particular effort to exert any influence. The dentists have made their own deductions from his published work.

In the field of medicine, the work of Dr. Frank Billings of Chicago, published as the Lane Medical Lectures, entitled "Focal Infection" has been widely read; and where they have been accepted as a guide to practice, we find that judgments are sane and reasonable. His conclusions are based on the work also of Ludvig Hektoen, E. R. LeCount and H. Gideon Wells. He tells us, too, that Drs. D. J. Davis, R. T. Woodyatt, H. K. Nicoll, W. E. Post, E. E. Irons, A. M. Moody, and others have contributed notable work in bacteriology, in chemistry and in experiments on animals. Therefore, his advice to the medical and dental professions, the result of a composite of the opinions of many men, is of greater value and more worthy of credence than the work of Price, whose laboratory assistants and co-workers are unknown to us, not having been dignified by grateful mention in any of his publications, since the closing of the Research Institute in 1921. Dr. Billings has not paid any attention to the literature of dentistry, drawing his bibliography almost entirely from the field of medicine.

The next book of importance in this review to my mind was that written by Dr. William W. Duke, professor of experimental medicine, in the University of Kansas, School of Medicine,

and professor in the department of medicine in the Western Dental College. Dr. Duke has reviewed the literature of focal infection thoroughly, and has seen fit to include in his bibliography references from the work of the dental profession. In all, his bibliography comprises the work of 125 men, and among his conclusions, he has this to say: "The immediate therapeutic result which follows the eradication of oral sepsis varies, and the more conservative often hesitate to promise too much. On the other hand, it is often disappointing." He says, further, "It is likely to be disappointing, if the removal has been incomplete, or if other *coexisting infections have been left intact,* also, if extreme anatomic changes have been brought about as a result of chronic systemic infection. The best results are obtained in those instances where the systemic effects are toxic. These cases present a brilliant result and often can be secured within a short time." And while he advises the removal of teeth with damaged roots, he says that frequently conservative methods *are justified*, especially, if the resulting systemic diseases are not extremely serious and if there exists no constitutional disorder, such as diabetes or severe anemia, which may lower resistance to infection, and decrease the likelihood of success. He stresses the fact, time and time again, that dental infections frequently depend on other diseases, which reduce the vitality and resistance of the individual to a point that permits and encourages dental infection. All told, the work of Duke is constructive and conservative, and he strongly emphasizes prevention, which he says should begin in early childhood.

While there are many other authors who have written more or less comprehensively on this subject, time will scarcely permit me to review them all. The five I have chosen to call particular attention to are outstanding men in this field and reflect in composite the views now held to a great degree by both dentistry and medicine.

I will now review the publications which support the views that both tooth pulps and their investing tissues contain bacterial growth. In a paper,[1] entitled "The Bacteriology of Vital Pulps," Henrici and I reported that the living vital pulps of forty-one teeth out of 115 contained growing micro-organisms. *Streptococcus viridans* was found twenty-nine times, *Staphylococcus albus* eight times, diphtheroid bacilli three times, spore-bearing aerobes two times, *Staphylococcus aureus* once; *B. proteus* once, *Streptococcus hemolyticus* once, and *B. coli* once. The method followed to exclude external growth was to saturate these teeth in tincture of iodin, crack them open, pluck out the pulp with flamed pliers and transfer it to the culture medium.

Bear in mind that the pulps of these teeth were not exposed. Of the 115 teeth, twenty-two were normal as to enamel and gingival margin. The pulps of the normal teeth yielded negative cultures. Forty teeth showed pyorrhea only, with no caries. Forty-two per cent of this group had infected pulps. Twenty-three of these teeth had caries only, but without exposure of the pulp. Forty-three per cent of these twenty-three teeth contained bacteria growing in the pulp. Thirty of these

1. Henrici, A. T., and Hartzell, T. B.: J. Dent. Res., 1: 419 (Dec.) 1919; Bacteriology of Vital Pulp, J.N.D.A., 7: 375 (April) 1920.

teeth showed both caries and pyorrhea. Forty-four per cent of the thirty teeth had bacteria growing in the pulps.

From five specimens, two varieties of organisms were isolated: *Streptococcus viridans;* with *Staphylococcus albus* twice. The result of this bacterial examination of vital pulp confirmed, in a general way, the studies by Collins and Lyne.[2]

In a microscopic study of pulps from infected teeth by Henrici and I[3] active inflammation was shown in fourteen pulps from forty-one infected teeth, or 37 per cent; which is ample confirmation of the opinion previously arrived at from bacteriologic studies that the pulp may be invaded by micro-organisms long before it is actually exposed by caries; and that it may be repeatedly injured long before it actually undergoes necrosis, and often protects itself from continued bacterial irritation by formation of secondary dentin.

In 1917, Henrici and I[4] described a rational technic for the study of bacteria deep in the tissues beyond the lesions of pyorrhea pockets, by thoroughly cleansing the surface of the gum and tooth by drying the area so cleansed and packing it off with dry sponges, bathing the area with tincture of iodin, and then burning with the actual cautery the superficial tissues of the pocket; and, after the field was sterilized and the superficial layers of burned tissue removed with their surface bacteria, cultures were made from the deep tissues and pure cultures of streptococci were usually obtained; that is, we applied to the periodontal membrane the principle which Kantorowicz and Neidergesäss used in studying the bacteriology of dentin and arrived at similar results and conclusions, to-wit: the organisms found in the advancing border of the active disease process in pyorrhea alveolaris are streptococci.

Kligler, in his "Bacteriology of the Surfaces of Teeth,"[5] removed and weighed, then properly diluted, bacteria occurring on the surfaces of teeth. Counts were made both by direct observation through the microscope and by plating on various mediums. In this manner, not only was the actual number of organisms presented determined, but also the infrequent and accidental forms were excluded. The relative numbers of the different kinds of bacteria were made known. This study yielded some very interesting results. The cases were divided into nine groups, according to the condition of the mouth, starting with the immune and passing through increasing degrees of mouth uncleanliness to advanced stages of caries. There was found, naturally, a progressive increase in the number of bacteria present from the first to the last group. More interesting were the findings in regard to the relative number of the various groups of organisms present. Streptococci, which form almost one-half of the organisms on the tooth surface in the healthy immune mouth, gradually decrease and, in caries, are largely replaced by other forms,

2. Collins, K. R., and Lyne, H. C.: Preliminary Report on Bacteria Found in Apical Tissues and Pulp of Extracted Teeth, J.N.D.A., 6: 370 (April) 1919.

3. Henrici, A. T., and Hartzell, T. B.: J. Dent. Res., 2: 537 (Dec.) 1920.

4. Hartzell, T. B., and Henrici, A. T.: Pathogenicity of Mouth Streptococci and their Role in the Etiology of Dental Diseases, J.N.D.A., 4: 477 (May) 1917.

5. Kligler, I. J.: J. Allied Dent. Soc., 10: 282, 1915.

particularly the rods. It is to be pointed out that this decrease is only relative, and if his percentages are converted into actual numbers, there is found a very considerable increase of streptococci in the dirty and carious mouth. It is to be noted also, from his tables, that while the actual number of organisms in the dirty mouth is much greater than in the clean, the relative proportion of the groups remains much the same. Kligler found, by actual weight and count, that the bacterial mass on dirty teeth in numbers amounted to as much as 800,000,000 micro-organisms to 1 mg. of tooth scrapings. In the clean, immune mouth, the number of bacteria was 9,000,000 or more to a milligram of tooth scrapings. Please keep in mind that relatively one-half of this mass is always composed of streptococci, taking into consideration in this connection also the work of Madam Brailovsky-Lounkevitch.[6] This author examined smears and cultures from the tongue, cheeks and gums of a number of individuals, from new born infants to adults. In all such studies, a large number of adventitious or accidental microbes have been encountered. The pneumococcus was encountered in the mouths of infants in hospitals, but was usually absent in children at home. These organisms, not essentially oral in their habitat, have been recognized and noted by Brailovsky-Lounkevitch as accidental visitants. Her investigations have established certain important facts: The mouth at birth is sterile. From the sixth to the tenth hour, it develops bacterial flora, recognizable at the tenth hour by direct microscopic examination. The first organisms found are various cocci (staphylococci, streptococci, the pigment-forming cocci of the air) and spore-bearing bacteria. From the first week until the appearance of the teeth, there is but one organism which may be considered constant, *Streptococcus salivarius*. From the twelfth day, it is the predominant species. With the appearance of the teeth, the flora which had previously been uniform throughout the mouth changes. There are added certain other species which live by preference in the gingival crevice and in the interproximal spaces. The flora of the adult mouth is practically the same as that of infants after dentition. *Streptococcus salivarius*, occurring as diplococci or short chains on the squamous epithelial cells, still forms the predominant species. On the cheeks, it is practically the only organism, but on the tongue, it may be accompanied by some of the rods and spiral forms noted in the gums.

Kantorowicz,[7] found streptococci deep in the sound dentin. Sieberth,[8] in his work on pulpitis, "Die Microorganisms der Kranke Zahn Pulpa," greatly to his surprise, found streptococci in pure culture in unexposed nonvital pulps. Goadby,[9] by excavating the surfaces of cavities, alternately cauterizing and excavating, came ultimately to the deepest layer of diseased dentin, which yielded streptococci, *Staphylococcus albus* and a gram-positive bacillus. Kantorowicz, using the same method,

6. Brailovsky-Lounkevitch: Contribution a l'etude de la flore microbienne habituelle de la bouche normale, Ann. de l'Inst. Pasteur, 29: 379 (Aug.) 1915.

7. Kantorowicz: Deutsch. Zahnheilk., Vol. 21.

8. Sieberth: Dis. Erlangen, 1900.

9. Goadby: Mycology of the Mouth, New York, Longmans, Green & Co., 1903. Mantel, Alfred: Brit, M. J., 1, 1877.

completely confirmed Goadby. Black, in the sixteenth lecture in his course on operative dentistry, in Northwestern University Dental College in 1900, published in 1901, demonstrated streptococci deep in the tubules and interglobular spaces of decaying dentin. In the same year, he demonstrated streptococci in the gelatinous film over whitening decalcifying areas of enamel. Smithies, then of the Mayo Clinic, made an examination of 2,500 stomach contents and always found bacteria. Henrici and Hartzell[4] found in a series of animal experiments, in which rabbits were inoculated with streptococci of the lower bowel, that heart, joint and kidney lesions were as often caused by *Streptococcus fecalis* as by streptococci from the mouth.

I have made this review of evidence to prove the statement, that "the premise involves all teeth both vital and pulpless, for they all support bacterial growth," and the alimentary canal as well. I now have repeated that statement with the intention of showing how impossible it is to get rid of the streptococci by the extraction of teeth. Streptococci occur in the alimentary canal from the mouth to the anus. The pulps and tissues of the teeth are only a part of the tissues that are constantly bearing them. My reason for the foregoing citations and the statement I have just made is to show the fallacy of the assumption that the presence of streptococci in or on teeth always indicates death dealing disease, any more than does their constant presence in the stomach, intestines and lower bowels, or in the nose and sinuses.

If we are to condemn all teeth that support bacterial growth, and be consistent, we must extract all teeth, for they all support bacterial growth on their protected surfaces, and bacteria exist in the pulps of many living teeth as well as in the pulp chambers of badly or faultily treated pulpless teeth. It is, therefore, unreasonable to condemn these teeth, because it is so easily possible to reduce to a safe minimum the growth of streptococci on their surfaces and in the tissues surrounding them.

Now let us review some of the evidence upon which the indictment of the pulpless tooth rests, and upon which men are making their decisions to remove or extract teeth. We find that it is of two classes. One might be designated "research evidence, based on bacterial findings and the production of lesions in animals." The second type is clinical. To illustrate: A man extracts a diseased tooth for a patient who is suffering from some form of physical ailment. Coincidently with, or shortly following the removal of the offending tooth, his patient makes a brilliant recovery. At once the assumption is that it was the removal of the offending tooth that produced the benefits; which is often, in the light of subsequent developments, without justification, as the following incidents show.

In the earlier years of my work, I was called on to treat a case of pernicious anemia in the university hospital. The red cell count was 2,000,000; hemoglobin, 40. After the removal of some diseased teeth, the red cells began to mount and the hemoglobin increased. Presently, the man was discharged from the hospital with the red cells almost 4,000,000 and hemoglobin 70. An enthusiast might have jumped to the conclusion that here was the explanation of pernicious anemia. In less than four months, this same patient was back in the hospital, and he finally died of pernicious anemia.

In cases of extreme hypertension, I have repeatedly seen a hypertension of 200 mm. or more drop rapidly after the elimination of focal infections in the mouth. Unfortunately, few of these cases retain the advantage that seemed to be gained by the removal of pulpless and infected teeth. Slowly but surely, the blood pressure has again risen, perhaps not always to the height that it was in the first observation, but sufficiently to show that the focal infection was not the original cause. In several instances, it was finally determined that the hypertension was, in fact, due to arteriosclerosis or chronic glomerulonephritis; and the lowered blood pressure was probably due to the rest in bed and lessened food consumption. In only a few instances has tooth extraction permanently lowered blood pressure.

I mention these experiences to point out the fact that we should be extremely cautious in interpreting clinical evidence. Unquestionably, many lives have been saved by recognition of the possible influence of focal infections and their eradication. I would not in any way minimize the value of this advisable and sensible treatment, but what we as dentists and physicians most want is the ability to see the actual truth without false interpretation, to the end that our conclusions are justified. It is

Fig. 1.—Author's first case relating tooth infection to rheumatism; showing restored shoulder action. The source of the infection is shown in Figure 3. (Figs. 1-7 reprinted from N.D.A. Bull., March, 1914.)

Fig. 2.—Of historical value as being the second case in the literature showing the relation of focal infection to rheumatism in which laboratory findings were given. The degree of extension of arms is shown. The patient could not lift the hands to the face before treatment was commenced.

the most unfortunate thing that can happen to a patient intrusted to our care, when an important element in the nutritional mechanism is broken down, only to result in that patient suffering more and dying sooner than he would have done had he been left alone.

Let us now examine the research phase of this evidence. The earliest investigation of a research type using animal inoculation was made by Alfred Mantel, consulting physician to the

Fig. 3.—Source of infection in author's first case definitely relating tooth infection to rheumatism and the second instance in the literature as far as is known to the author in which laboratory proof is submitted.

Royal Halifax Infirmary, Harrogate, England. When he commenced his work, bacteriology was in its infancy. His first paper[10] was entitled, "The Etiology of Rheumatism Considered from a Bacterial Point of View." A review of his work,[11] by himself, was published in 1912. He obtained infected joint fluid, studied the bacteria in it and attempted to create experimental rheumatism by inoculating two monkeys. In this he failed. His work is notable, because he is the first man to associate bacteria with rheumatism, as far as I know. No man, as far as I am able to learn from the literature, has been able to cause typical arthritis deformans by means of animal experiments; nevertheless, many men have been able to isolate bacteria from joint fluids. Many research workers, since that time, have been able to make acute infections of joints by means of inoculating animals, so it seems that Dr. Mantel should have credit for initiating this line of research. The bibliography of this subject shows that a great many men have worked on it. As far as relating dental infections to arthritis is concerned, let me here state that, to the best of my knowledge and belief, the first observations in this field were made by Goadby. An account of three cases which he treated by the removal of diseased and infected teeth, in which recoveries were made of a satisfactory nature, was published in 1912.[12] Dr. Goadby recovered bacteria from diseased teeth and inoculated rabbits with them, producing a type of arthritis, but not the common deforming type. The joint inflammations produced by him were of the acute septic type. Chronologically, the next paper bearing on this subject relating tooth infection with rheumatism was published in 1914.[13] In this brief article, the record of two cases beginning Jan. 1, 1914, recites the hospital history of a man, aged 24, who had been confined in bed nine months with chronic rheumatism. A first molar tooth, which was badly abscessed,

10. Mantel, Alfred: Practitioner, 88: 185 (Jan.) 1912.

11. Mantel, Alfred: Practitioner (Spec. No. on Rheumatism), 78 (Jan.) 1912.

12. Goadby, K.: Practitioner, 88: 107, 1912.

13. Hartzell, T. B.: Case Reports, N.D.A. Bull, 1: 4 (March) 1914.

was extracted. This account includes pictures (Figs. 1-2) of the patient and a radiogram of the abscessed tooth (Fig. 3), and the laboratory findings and the treatment given in this case, which was followed by recovery. In the same report is a record of the case of Mrs. M. B., white, an American, aged 32, occupation, general house work, whose ordinary weight was 145

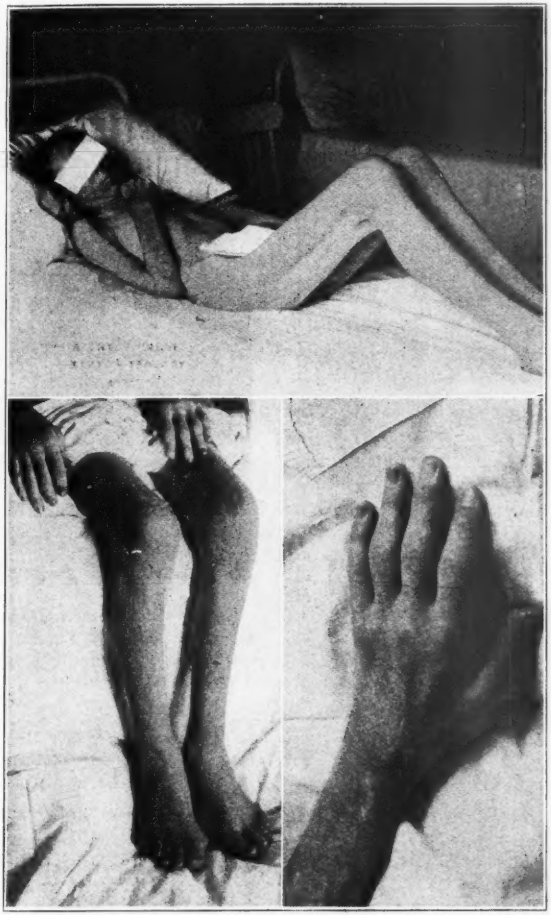

Fig. 4.—Above: Appearance of patient, showing the degree of extension of the limbs possible for many weeks before treatment was commenced; also the emaciated condition of the patient at the time treatment was begun. This woman was bedridden and helpless. Below: Swollen condition of hands and feet.

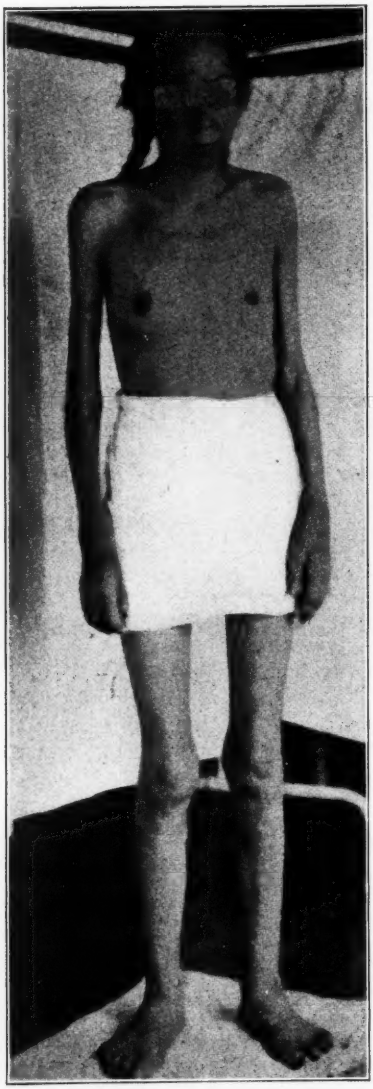

Fig. 5.—Patient shown in Figure 4. A few weeks previous, she was bedridden and in pain. This picture is reprinted to show the progress of research investigation, and as evidence that the author was among the early investigators of focal infection in its relation to secondary or metastatic disease. This case commenced with scarlet fever, and the tonsils were removed. The tooth infection proved to be the continuing focus of infection.

pounds, and weight at the time of sickness, 100 pounds. The patient was confined to bed and unable to move. Pictures showing the patient's emaciated condition and the swelling of the hands and feet before treatment (Fig. 4) and subsequent pictures of the patient after she had gained control of her body once more (Fig. 5), together with pictures of the diseased teeth removed (Fig. 6), constitute the burden of this preliminary report.

Fig. 6.—One of the sources of infection in the patient shown in Figures 4 and 5. The joint infection commenced during an attack of scarlet fever.

Since, in the course of this analysis, it will be my duty to review some of the work of my colaborer, Dr. Price, and others, I will state that in this same issue of the *Bulletin* we are shown for the first time a picture of Dr. Price's clinical recorder (Fig. 7), on which he spent fifteen years of effort, and a short paper by him on defective tooth development. The next paper,[14] in sequence, to appear on this subject, is the report of the Mouth Infection

14. Hartzell, T. B.; Henrici, A. T., and Leonard, H. J.: Report of the Mouth Infection Research Corps of the National Dental Association, N.D.A. Bull., 1: 48 (Oct.) 1914.

Research Corps of the National Dental Association on work which was commenced in September, 1913, and ended July 1, 1914. In this report are given

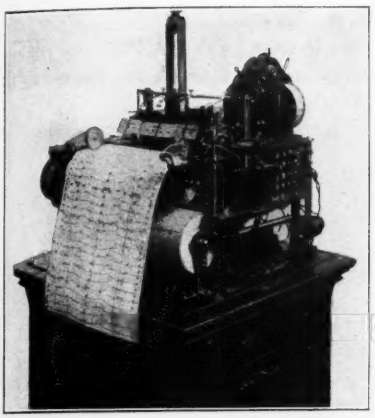

Fig. 7.—Price's automatic clinical recorder for taking and recording the pulse, respiration and temperature. Though not adopted by medicine, it is presented here to show the kind of investigation claiming Dr. Price's energies at that time.

observations on the study of mouth infection in eighty-two hospital cases. The technic followed in obtaining the material from the mouths of these patients, and of the treatment given, is

Fig. 8.—Case of arthritis deformans of the hand. Figures 8-13 are reprinted from the N.D.A. Bull., October, 1914, because of their historical value in this discussion and to show that, in 1914, a fair knowledge obtained as to what streptococcus viridans might do in the human tissues, as revealed by animal experiments.

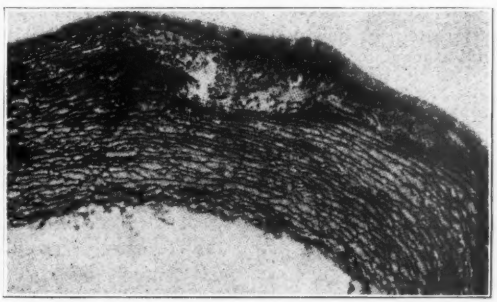

Fig. 9.—Section of aorta of rabbit which died forty days after injection of streptococci from one of the author's cases. The rabbit showed marked roughening of the ascending portion of the arch of the aorta. The section shows a destruction lesion in the media with a thickening of the overlying intima.

reported in full, with the results accomplished and the results obtained by passing on to animals bacteria from certain of these cases, causing lesions which throw light on the causation of the lesions found in the human being. This report covers twenty-two pages and includes pictures of *Streptococcus viridans* growing

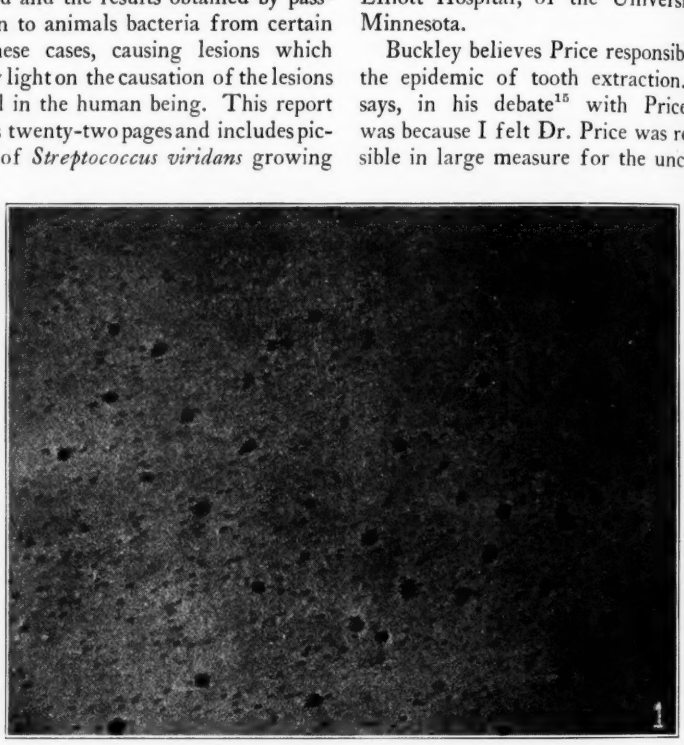

Fig. 10.—Blood agar plate showing colonies of Streptococcus viridans. The green colonies show as dark areas. A number of small gray colonies are also present. Figures 10-13 are presented in color in the original article.

green on blood agar and of heart, joint, arterial and kidney lesions, produced in animals with streptococci obtained from the mouths of these hospital cases. This is accompanied by the recital of experimental work on animals and is the first pathologic report of the kind ever to be published in the United States in which the lesion pictures were published in color (Figs. 10-13.) This report was checked by Dr. S. Marx White, professor of medicine of the School of Medicine, and on the medical staff of the Elliott Hospital, of the University of Minnesota.

Buckley believes Price responsible for the epidemic of tooth extraction. He says, in his debate[15] with Price, "It was because I felt Dr. Price was responsible in large measure for the uncertain state in which dentistry finds itself today in relation to this subject," and again (page 1501), speaking of publications by Price and others, "When read, they are considered by many as authoritative, accepted without question and quoted freely in justification of the radical stand many men are taking today with reference to the ruthless extraction or so-called surgical removal

15. Price-Buckley Debate, J.A.D.A., 12: 1499 (Dec.) 1925.

of all pulpless teeth;" and in his book, "Dental Infections and Degenerative Disease," comprising 412 pages, Price completely ignores all previous work on this great subject except the work of fourteen men and those only are quoted who support his views. As Buckley points out[15] (page 1503), Price admits in the above mentioned work (page 412) that he is the only authority. In view of these facts, I shall point out, as we go along, the sort of work Dr. Price, the dentist, has been doing to fit him to exercise this commanding authority.

So it is interesting to note that, in this same issue of the *Bulletin* there is a report from Weston A. Price on metallurgic, physical and electro-chemical researches.[16] I suggest that you remember this fact, because it indicates the kind of problems on which Dr. Price was then engaged; as the title indicates, quite unrelated to bacteriology, pathology or immunology, subjects on which he now, by many dentists, is accepted as an authority.

Fig. 11.—Section showing the heart muscle of a rabbit which died from chronic myocarditis sixteen days after an injection of streptococci from one of the author's cases. The section shows an area of fibrosis with several giant cells.

Just here, I might also point out that he stated in the Price-Buckley debate (page 1469),[15] "For those who may not understand my relation to this newer data, I shall perhaps be justified in stating that for more than thirty years I have maintained a private staff of workers assisting me in the details of my investigations in my private research

16. Price W. A.: Metallurgical, Physical and Electrochemical Researches, N.D.A. Bull., 1: 71 (Oct.) 1914.

laboratories. These intensive studies have included not only investigations of the premise upon which former practice has been based, but also a very extensive investigation through means of blood chemistry and various applications of biologic science to the study of the various aspects of these problems,

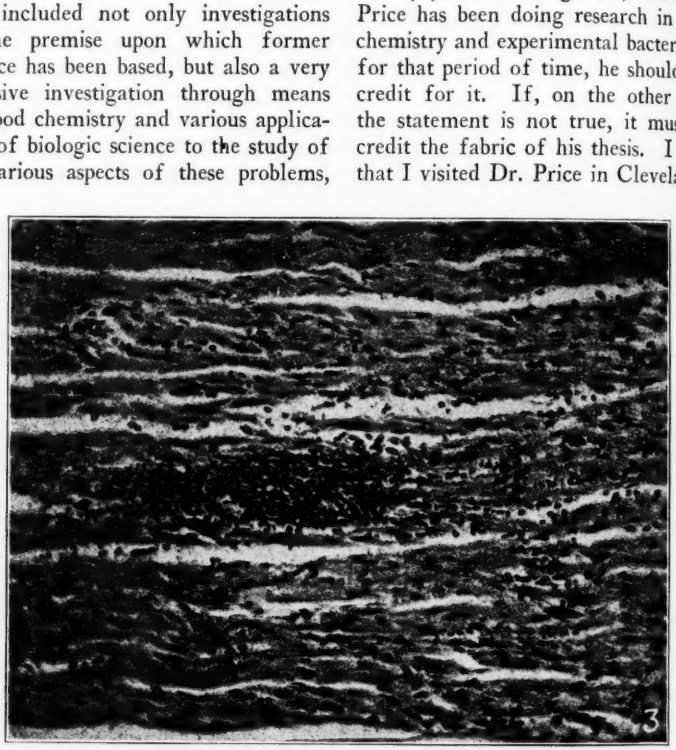

Fig. 12.—Section of heart muscle from a rabbit which died of acute myocarditis forty-eight hours after an injection of streptococci from one of the author's cases. The section shows an area of lymphoidal infiltration.

both in human beings and in experimental animals."

Since I am laying a foundation in fact for an opinion as to what we can fairly depend on to be truth and to establish by reliable evidence, as far as I can, whom we may believe and what we may believe as to the justice of the dictum that we must remove all infected teeth rather than to treat and save some of them, I suggest that we examine the foregoing statement. Thirty years is a long time, and if Dr. Price has been doing research in blood chemistry and experimental bacteriology for that period of time, he should have credit for it. If, on the other hand, the statement is not true, it must discredit the fabric of his thesis. I recall that I visited Dr. Price in Cleveland in that early decade and was shown through his offices and laboratory and a plant where he and his brother, I think it was, manufactured articles to sell. There I purchased a cataphoretic machine that was made by them, but I saw no evidence of blood or bacterial studies at that time, nor did Dr. Price speak of such matters. The science of bacteriology has been developed in the last thirty years. In fact, the only bacteriology taught in the College of Medicine of

the University of Minnesota in the winter of 1892 was the recognition of the tubercle bacillus in sputum by the use of carbolfuchsin stain, and the recognition of the gonococcus in fluid exudates. This I know, for I was the teacher who taught this, as part of my duty as instructor in pathology. As for

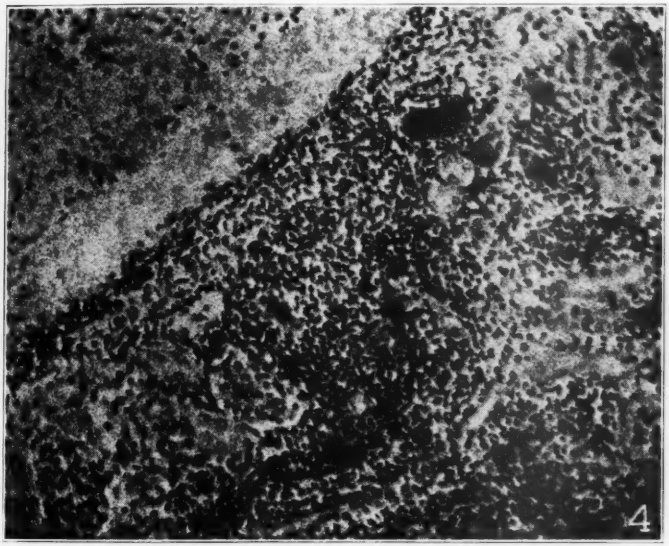

Fig. 13.—Section showing an area of widespread infiltration with lymphocytes and polymorphonuclear leukocytes in the kidney of a rabbit which died forty-eight hours after an injection of streptococci from one of the author's cases. This was the second passage of this streptococcus through rabbits.

animal inoculation, it was not even thought of in the medical school thirty years ago, and the study of "The Rôle of Calcium in Producing Life Phenomena" dates from the time of Sidney Ringer and of Lock, about 1890; and more particularly from study of the action of the salts by Jaques Loeb and his pupils, among whom were Professor Albert P. Mathews, University of Cincinnati and Dean Lyon of our School of Medicine, and these studies occurred from 1893 to 1900.[17] As a matter of fact, most of the work upon which Price's newer data is based is less than 5 years old, as you can see if you look at the list of his contributions as published in our index of dental literature and the bibliography of the subject of calcium metabolism in our scientific journals. In the close of his debate (page 1523)[15] Price announced some world shaking discoveries, to support his thesis that teeth must not be conserved, one of which is that tooth infection leads to the changing of calcium levels of the blood stream, thereby predispos-

17. Personal communications from E. P. Lyon and Albert P. Mathews. Mathews, A. P.: Minneapolis Dist. Dent. J., 8: 5, (Dec.) 1925.

ing to the development of sensitization reactions, to cancer, tuberculosis, diabetes and the anemias, on the one hand, and, on the other hand, to the rheumatic group of degenerative diseases; two groups, which together furnish the great majority of deaths in the various communities. He bases these conclusions upon research work, which he has done, which is unsupported by evidence of truth, and may be as unreliable as that other statement he made that the reduction in heart disease in Minnesota is due to the alleged fact that the conservation of pulpless teeth is not taught in the Dental School of the University of Minnesota. I now append the usual technic followed in making a calcium estimate in the department of biologic chemistry of the University of Minnesota, analyses Price professes to have made on the blood of 1,100 persons and on the blood of many animals. He does not inform us what his method of arriving at these calcium analyses is. The technic appended shows that each analysis requires many hours of labor. This method was devised by Guy W. Clark, professor of biochemistry and pharmacology of the department of biochemistry at the University of California, who checked it by a thousand analyses before he published it.

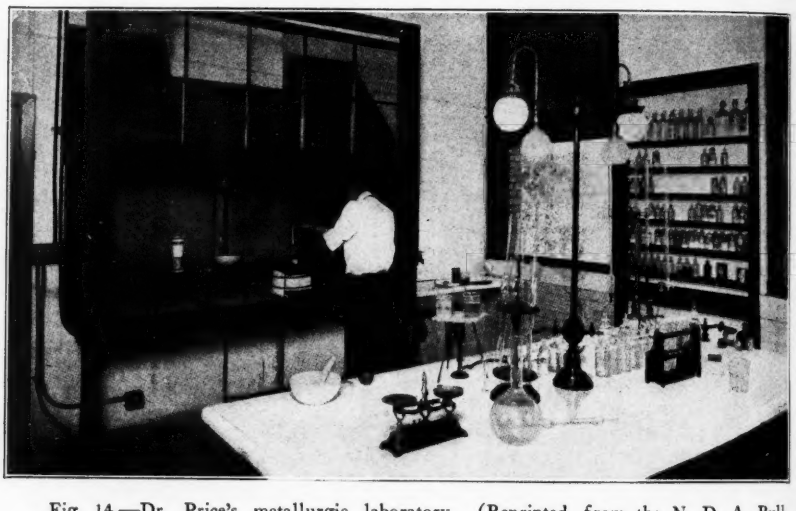

Fig. 14.—Dr. Price's metallurgic laboratory. (Reprinted from the N. D. A. Bull., November, 1913.)

CALCIUM. *Principle.* Calcium is precipitated as calcium oxalate, and the oxalate is titrated against potassium permanganate.

Reagents. 3 per cent *ammonium oxalate* (for precipitating calcium.)

Sulphuric acid. (5 per cent approximately normal) Reacts with the oxalate and permanganate according to the equation:

$$2KMnO_4 + 5CaC_2O_4 + 8H_2SO_4 = K_2SO_4 + 2MnSO_4 + 5CaSO_4 + 10CO_2 + 8H_2O.$$

Potassium permanganate, 0.01N.

Procedure. Pipet 1 to 5 ml. (a millimeter is equivalent to a cubic centimeter) of serum or citrated plasma into a 50 ml. centrifuge tube, and while rotating the tube, slowly add 3 per cent ammonium oxalate, equal in volume to one-half the amount of serum or

plasma. Mix thoroughly and allow to stand over night. Rub down walls of the tube with a rubber policeman (washing the policeman with a small amount of distilled water), and centrifuge until clear; usually five minutes is ample time. Completely remove the supernatant liquid by means of a siphon or by careful decantation, stir up the precipitate with a fine stream of cold, distilled water, washing down the walls of the tube, using in all approximately 35 ml. of water. Centrifuge immediately and completely remove the wash water. Dissolve the precipitate in 5 ml. of approximately normal sulphuric acid, heated to 75°, and titrate with 0.01N potassium permanganate to the first faint pink.

Calculation. One ml. of 0.01N potassium permanganate is equivalent to 0.2 mg. of calcium.

You will note that this is a tedious and exacting analysis, costing many hours for each experiment; and, in announcing such important and far-reaching effects of tooth infection, it would seem that alleged discoveries of the type Price announces should be supported by the fullest evidence that he actually did, by recognized methods, do this work, and among the least of these proofs would be information as to how he did it. If, perchance, he followed Clark's method, which is a most reliable one, it is difficult to see where he secured the time to accomplish all of this since 1921.

Let me now quote Dr. Albert P. Mathews, professor of biochemistry, University of Cincinnati, and author of the most used textbook in biochemistry in the colleges of this country, who has spent his life in the study of biochemistry, as among those, who, as I mentioned before, commenced the study of blood chemistry in 1893, who says:

> We may be sure, I think, since calcium is necessary for all vital phenomena, that it will be found to be an important factor in immunity, and in resistance to disease. But while this may be expected to be the case, we must be on our guard against ascribing to it an exclusive and predominant rôle. Among these phenomena that are of most common and fundamental importance is the resistance to unfavorable conditions of the environment. This includes resistance to parasites and disease. All of the elements which are necessary for life will be found part of this mechanism against disease. *We must* be on our *guard against picking* out a *single* one of *these elements and ascribing to it predominant powers.*

Though Dr. Price's world-record-making discoveries in the field of calcium metabolism have been in print for two years, I note that Dr. Mathews, in the revision of his textbook, just out, has not included them.

But let us proceed. Price writes[18] of some practical uses in dental practice for tungsten and molybdenum; and again,[19] he reports a development of practical substitutes for platinum and its alloys; while we find an article[20] called "Some Evidence of the Importance of the Dental Path, as a Source of Serious Localized and General Infections," read by me, at Dr. Price's request, on the occasion of the dedication of the Research Institute in Cleveland.

Since we have come together to weigh evidence, I will proceed further. The Minnesota corps of the Scientific Foundation continued its work as published[13] and presented[21] hospital records

18. Price, W. A.: Some Practical Uses in Dental Practice for Tungsten and Molybdenum, J.N.D.A., 2: 39 (March) 1915.

19. Fahrenwald, F. A.: N.D.A. Bull., 3: 47 (March) 1916.

20. Hartzell, T. B.: N.D.A. Bull., 3: 172 (March) 1916.

21. Hartzell, T. B.; Henrici, A. T., and Leonard, H. J.: Report of the Minnesota Division of the Scientific Foundation and Research Commission, J.N.D.A., 3: 333 (Nov.) 1915.

and bacterial studies, supported by animal inoculation, showing the results by the inoculation of 112 rabbits with planted infections. I also reported on the endameba's power to phagocyte bacteria and gave a concise report of the

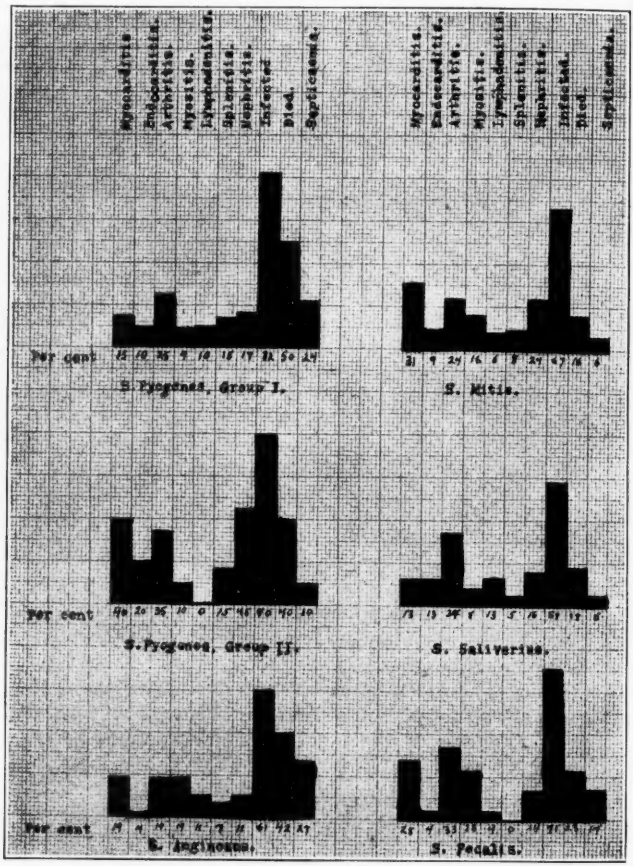

Fig. 15.—Chart based upon experiments showing that streptococci spread in the tissues in relatively the same proportions no matter what the source or type. Figures 15-17 are reprinted from the J.N.D.A., November, 1916.

twenty-two different strains of streptococci. I brought to the national meeting of that year some of the dissections to show the character of the lesions produced in rabbit tissues by these trans-

hospital work on sixty-six hospital patients ill with mouth and coincident infections of other parts of the body. I emphasized (page 334) the fact that much harm may result from too early

publication of such research work; the thought being then, as now, that it showed only one side of the question.

of the Commission on this subject of infections, we find in sequence "The Specificity of Streptococci,"[22] by Henrici

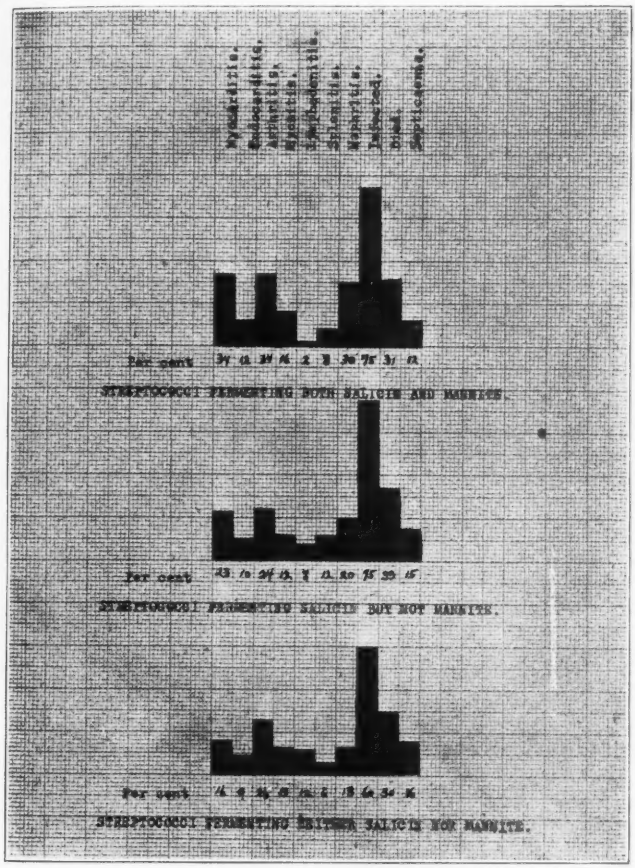

Fig. 16.—Chart based upon experiments showing that streptococci spread in the tissues in relatively the same proportions no matter what the source or type.

While this work led to reforms in dental practice, it has not constituted the whole truth nor finally settled this question.

We will, therefore, examine the literature further. Following the work who showed the results of the inoculation of animals with streptococci, collected from various sources, fifty-

22. Henrici, A. T.: J. Infect. Dis., October, 1916.

three strains of bacteria all told, using 225 animals; a colossal piece of work costing two years' labor, and showing conclusively that streptococci spread in the body in about the same tissues no matter whether they are hemolytic or nonhemolytic, and that streptococci from the lower bowel produce in animals about the same number of lesions in joint, heart and kidney, as streptococci from the mouth. In other words, if we inoculate an animal or a series of animals with streptococci from any source and make a careful search of all the animal tissues, we find them scattered in about the same proportions as the tables made by Henrici show, which leads us to believe that a more

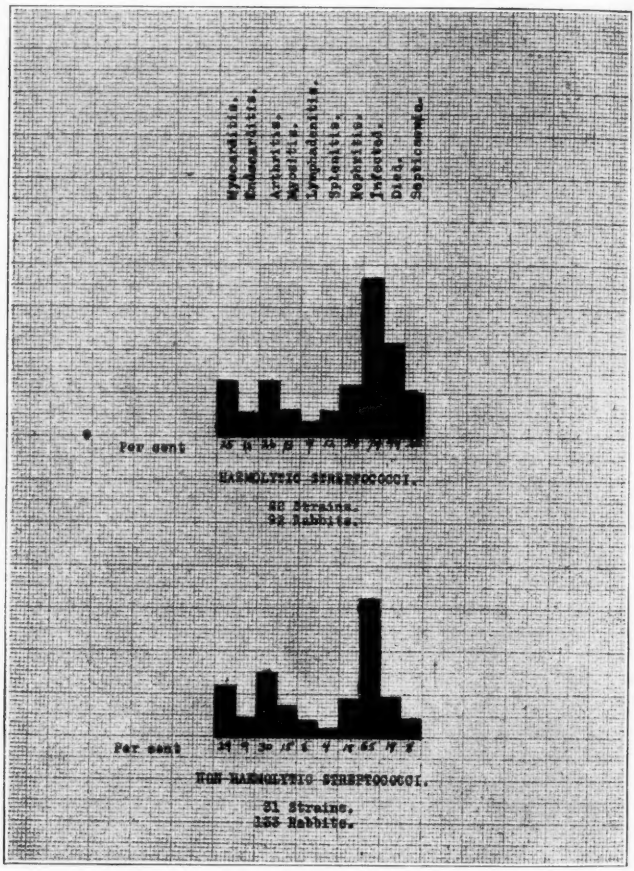

Fig. 17.—Chart based upon experiments showing that streptococci spread in the tissues in relatively the same proportions no matter what the source or type.

careful study of the infected animal tissues by Rosenow, Hayden and Price would prove to them, as it did to us, that a given dose of bacteria to a series of animals of about the same weight produces about the average of infection of the several tissues that the charts shown herewith reveal. This article by Henrici includes seven tables and eleven charts, and I quote his conclusions because they have a direct bearing on the question of selective or elective organ affinities so insisted on by Price, in his book, who rides this theory into the fog of absurdity, as shown by his statement in Chapter 60, where he claims to have caused angina pectoris in a rabbit by bacteria from a tooth. In view of the fact that the pathologic changes in a heart capable of causing pain are of slow development and with difficulty recognizable at postmortem, it is difficult to see how Price knew that the rabbit had heart pain, which is the characteristic feature of angina, and he seems to have depended on his imagination for proof, because he does not submit the pathologic findings. Again, on page 136, Volume 2, of his book, he reports a case of a young woman, struck with a golf ball, over the "region the ovary," who developed what Price described as ovarian pain, forgetting there are fifteen possible reasons, according to surgery, for pain in the lower abdomen, other than ovaritis. From this woman's tooth, he produced cultures that caused ovaritis in four female rabbits; while two males, receiving the same does, developed no pathologic condition. Again (Fig. 315), he produced, according to his statement, inflammation of the female genitalia of a rabbit by injecting cultures from the teeth of a patient who had syphilis. All syphilologists will, I believe, confirm the following statement, to-wit: that the primary lesion of syphilis occurs at the point of inoculation, and that it has no especial predilection for the genital organs. While it is quite true that the primary lesions in syphilis may occur, and often do occur, on the genital organs, it is because of contact with the infection there, and an injection of a tooth culture, which may have contained the spirochete of syphilis would not locate first on the genitalia unless it were put there in the beginning. These alleged results make the work of others in the field of elective localization seem tame indeed.

Henrici's conclusions as to the result of his work above mentioned are as follows:

Fifty-three strains of streptococci from various sources were inoculated into 225 rabbits, and the virulence and elective organ affinities were compared with the powers of hemolysis and carbohydrate fermentation.

The carbohydrate fermentation tests are of no significance from the standpoint of virulence, and of slight or doubtful significance from the standpoint of tissue localization.

The hemolytic streptococci are more virulent than the nonhemolytic, but the two classes localize in the same tissues with equal frequency.

We are not justified from evidence obtained by rabbit inoculation experiments, in recognizing any particular class of streptococci as specific for rheumatic fever, since the various rheumatic lesions, arthritis, myocarditis, endocarditis, and myositis, may be produced by some strains in each of the varieties, and are produced in equal proportions by both hemolytic and nonhemolytic streptococci.

Streptococci of various kinds produce in rabbits types of myocarditis which cannot be differentiated from the Aschoff-Geipel nodules generally considered diagnostic of rheumatism.

Experimental streptococcal endocarditis usually develops by implantation rather than by embolism.

Please note in the last paragraph that experimental streptococcal endocarditis usually develops by implantation rather

than by embolism, and embolism means that the infection floats into the heart muscles through the blood stream. Price would have us believe that heart disease is greatly on the increase, owing to focal infection about teeth. If this were true, then Henrici's conclusions, gained from the study of so many hundreds of rabbits postmortem, that experimental endocarditis develops by implantation rather than embolism cannot be true. They cannot both be right. There may be enough bacteria in the blood stream so that the whipping of the valves encounters the bacteria and bruises them into the heart surfaces. This is what the necropsy shows. And if Dr. Price were right in his contention, the increase in heart disease would have to show coincidently with it septicemia of sufficient gravity to provide bacterial emboli and produce endocarditis. This is not the case, and it is, therefore, wrong to charge to focal infection arising from teeth the increase in heart disease. In commenting on heart disease, Henrici, the 1922 mortality statistics published by our government, makes the following statement: "In making comparisons it must not be forgotten that nearly all persons who die of heart disease have passed middle life, and, therefore, the crude death rates should be used with caution, and considered only in connection with the age and distribution of the population." (page 55.)

Louis I. Dublin, statistician for the Metropolitan Life Insurance Company, says,[23] "Obviously some of this increase of heart disease is the direct result of the influenza epidemic, which broke out in the early months of this year." He points out, however, that this cannot be the whole cause, and states further, "We shall have to watch the developments for the rest of the year very carefully." You will note that he makes no mention of dental disease as a contributory factor, and I remind you that the Metropolitan Life Insurance Company maintains a special department for the study of dental diseases, at the head of which is Dr. Thaddeus Hyatt, an exacting and careful observer. Dublin points out some striking facts. He says, "The greater prevalence of heart disease among colored people is notorious; colored males show rates from heart disease during the main period of life from 65 to 80 per cent higher than for white males at the same ages; those for colored women are twice as high as for white women, at a number of age periods of life." (This cannot be chargeable to teeth.) "Possibly the higher prevalence of such diseases as syphilis, malaria and typhoid fever in the colored race plays an important part in creating the excess of heart disease mortality." In his summary, Dr. Dublin says: "It is very obvious, however, that our information with reference to heart disease, both as a cause of sickness and of death, is very fragmentary. At the present time, there is no agency or machinery for collecting the facts by means of which the campaign against heart disease can be properly guided." In his paper, "The Incidence of Heart Disease in Adults," read Feb. 5, 1920, before the Association for the Prevention and Relief of Heart Disease,[24] he states, "The rate from heart disease varies considerably

23. Dublin, L. I.: Nation's Health, 4 (Aug.) 1922.

24. Dublin, L. I.: New York M. J., 111: 622 (April 10) 1920.

with the age period of life, being the lowest in early ages and highest in the advanced ages." In a paper entitled, "Some Problems of Life Extension," read before the Section on Preventive Medicine and Public Health of the American Medical Association, Chicago, June 13, 1924; he says: "In middle life, there are indications that the mortality rate is improving. For the age division between 45 and 64 years, between 1921 and 1900 the death rate for males declined 31 per cent and for females 35 per cent. Most of this favorable showing was accomplished between 1918 and 1921. For the first fifteen years of the present century, there have been indications that perhaps the death rate in middle life was increasing slightly. But following the war, a decided drop in the death rate occurred at this age division of life. This decline is ascribable almost entirely to greatly lessened mortality from tuberculosis and pneumonia of this division in life, and not particularly to any pronounced change in the death rate for the cardiovascular-renal diseases;" which are streptococcal.

Aschoff,[25] one of the greatest living pathologists, who was called to the United States in the spring of 1924, to deliver the Edward G. Janeway Lectures of the Mount Sinai Hospital in New York, the Lane Lectures of the Leland Stanford Medical School in San Francisco, the Osler Memorial Lecture of the County Medical Association in Los Angeles, and numerous other lectures, has this to say in his monograph on heart failure: "Having studied the whole heart histologically, I must believe that these areas of infection" (speaking of infection in the heart muscle, on page 48 of his monograph on heart weakness and failure) "play a very unimportant part in heart failure as a genesis of death, because the damaged areas are so minute in comparison to the great mass of uninjured muscle tissues." He further says, in the summary of his monograph on heart muscle disease: "We have shown that the peculiar weakness of the hypertrophic heart muscle, so far as our methods and experience reach, cannot be explained, either by the localized inflammatory processes nor for the greater number of heart valve diseases by the amount of anatomic lesions."

In view of the fact that tooth infection is a factor in causing heart muscle infections, provided Aschoff is right, we are attaching undue importance to them. The analysis of the cause of death in the case of the 650 hearts which we have in storage with their clinical histories, made at my request, would seem to indicate that there are as many deaths from hypertension as from acute streptococcal infection. And please do not forget that among them one-sixth of all the deaths were due to coronary sclerosis, and 10 per cent of the deaths were due to syphilitic aortitis. If it were true that tooth infection is increasing heart deaths, then the death from streptococcal infection must, of necessity, show a great increase over those due to hypertension; whereas, Professor Bell's figures indicate that only 33 per cent of all these deaths from heart lesions were due to nonhemolytic streptococci, as the accompanying table shows:

25. Aschoff and Tawara: Die heutige Lehre in den Pathologisch-anatomischen Grundlagen der Herzschwache.

PERCENTAGE OF DEATHS DUE TO VARIOUS HEART LESIONS

Condition	Per Cent
Hypertension	32
Coronary sclerosis	16
Old valve defect	17
Subacute	13
Primary acute	2
Secondary acute	5
Syphilitic aorta	10
Acute rheumatic	2
Adherent pericardium	2

One of the evidences why we should question Price as a leader is found in the following quotation,[26] and this statement was made deliberately, with the intention of influencing your judgment and mine, to cause us to believe that when we fill or preserve a tooth, the pulp of which has been lost, we are contributing to the possibilities of death of the individual: "Will you please note (Table 1) that in Minneapolis, in whose state institution for the teaching of the art and science of dentistry, root filling has not been taught for six years, and where the entire community has been both directly and indirectly influenced by that advanced position, the death rate percentage of heart disease has been, in 1923, 13.1, and in 1924, 12.4 per cent."

The following letter proves the foregoing to be a misstatement of easily ascertained facts. Dr. J. M. Walls, professor of operative dentistry in the College of Dentistry of the University of Minnesota, commenting on the foregoing statement, writes as follows:

Oct. 19, 1925.

Dr. T. B. Hartzell,
710 Physician & Surgeons Bldg.,
Minneapolis.

DEAR DR. HARTZELL:

Replying to your inquiry regarding the features of instruction followed in the Dental College, pertaining to the teaching of conservation of pulpless teeth, I may state the situation as follows. We are teaching the conservation of pulpless teeth in cases where from systemic evidence and local appearances, we might expect to secure the most favorable results. For individuals of normally high resistance, where there has been no serious periapical involvement, pulp removals and canal sterilizations are followed when ability to maintain sterilization through rubber dam application is possible. The greatest care is observed in avoiding irritation of the periapical tissue either by physical or chemical trauma. The students are given a thorough course in the theory of pathologic changes that occur with pulp irritation followed by pulp infection, and the theory of the practice of pulp extirpation and root canal sterilization. Each student passes a technic course using extracted teeth, and in practice is expected to carry a number of cases through in the clinic. The technical methods briefly stated for treating and filling root canals is as follows: Thorough physical removal of all pulp and membrane of canal to approximately the root end. The use of sulphuric acid and soda and peroxide of hydrogen are the most commonly followed methods for aid in the opening up of canals. Where the canals are infected tr. of iodine is flowed into canals and left for three or four minutes, then washed with alcohol and a dressing of beechwood creosote or eugenol is sealed in canals by the use of Medi Cement. As root filling an iodoform paste is carried into the canals by teasing with a broach so as to paint the surfaces, and a gutta percha point dipped in chloroform or eucalyptol is gently pumped to place. We have practically abandoned the strong escharotics and formalin in the treatment of teeth.

Sincerely yours,

J. W. WALL.

It would seem that Dr. Price must seek some other cause for the reduction of 1 per cent in the heart disease death rate in Minnesota, and, if I might make a suggestion, may it not possibly be due to the lessened consumption of alcohol and the tremendous increase in bank deposits by those of our people who do the hard work, who live in better homes, and eat better food, than did some of

26. Footnote 15, p. 1470.

this same group of citizens before the enactment of the Eighteenth Amendment? Or perhaps it is due to the fact that dentistry in the Northwest preserves so many more teeth, than in the

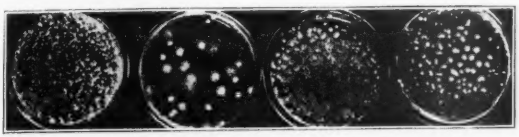

Fig. 18.—Petri dish cultures reproduced from Price's book "Dental Infections and Oral and Systemic Diseases" (page 506). These are apparently contaminated cultures. Certainly they are not streptococci, having none of the characteristics of that organism.

areas where the high death rate obtains, which means increased nutrition, producing greater immunity to infection. I repeat that Dr. Price is not a safe leader, particularly in the field of bacteriology. In 1916, he exhibited in a motion picture film, to prove the cause

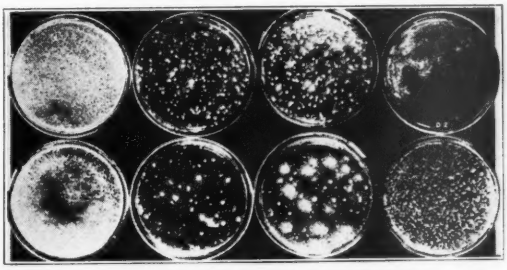

Fig. 19.—Petri dish cultures reproduced from Price's book "Dental Infections and Oral and Systemic Diseases" (page 507). These are apparently contaminated cultures. Certainly they are not streptococci, having none of the characteristics of that organism.

of pyorrhea, an organism, which he called *Bacillus X*. This is the incident referred to by Dr. Buckley.[27] This bacillus, so far as could be determined by an observation of the film, was pronounced to be the hay bacillus, otherwise known as *Bacillus subtilis*, the commonest laboratory contaminate of culture mediums. It required the joint opinion of the pathologic and bacteriologic staffs of the School of Medicine of the University of Minnesota to convince him of this fact. It was quite evident from the manner in which he secured his blood for culture that he knew nothing of the methods of blood culture work, for he stated that he obtained this bacillus from the blood culture of pyorrhea patients by pricking the ear and collecting the blood as it oozed out, instead of obtaining it through a previously sterilized field, overlying some large vein, by means of a sterile empty hypodermic syringe. Neither was he

27. Footnote 15, p. 1502.

a safe guide or a dependable source of information in his book, "Dental Infections and Oral and Systemic Diseases." On page 506 of that work, he exhibits petri dish cultures to show the bactericidal properties of the blood of patients with a high and low resistance, respectively. All of his petri dish cultures shown to illustrate the power of blood to destroy streptococci are contaminated, and, therefore, prove nothing. The colonies on plates A and B are entirely different organisms. The same is true of his plates, Figure 243, page 507, in which he compares the blood serum of a normal and of an infected rabbit. On none of these plates does he have a streptococcus, as you can judge for yourself by comparing them with those made by Larson and Henrici. You will note that, in these two pictures, the islands of growth on the culture mediums are very small. Note also that, in all the pictures of cultures made to show the bactericidal power of blood for streptococci, the growth is very heavy, in large islands, and in some instances completely over-grows the plate culture. You will note also that they are not all of the same character, which means there are several different sorts of bacteria growing in these cultures. On all except two of the plates, Dr. Price has two, if not three, micro-organisms contaminating his cultures. In the field

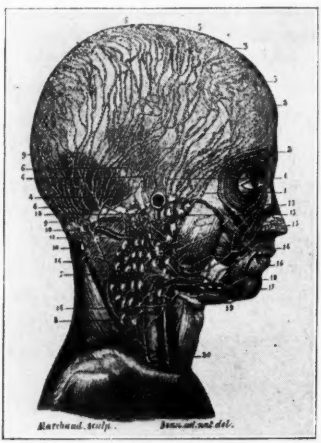

Fig. 20.—Lymphatic glands of the face and head.

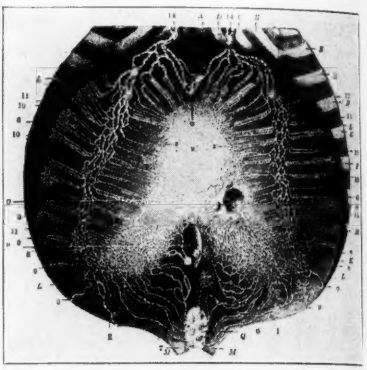

Fig. 21.—Lymph supply of the diaphragm.

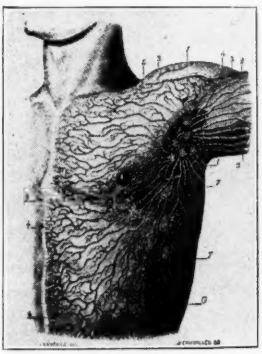

Fig. 22.—A portion of the lymph supply of the trunk.

of immunology, he recommends autolyzed or digested vaccines to stimulate metabolism, notwithstanding the fact that it has been common knowledge for twenty years that digested vaccines have lost the power to immunize, and their toxins inhibit metabolism, a fact which is responsible for the great falling off in the use of vaccines by the clinicians of this country.

One of our great internists, Dr. Frank Billings,[28] says he managed some patients with, and some without, vaccination, but all of them on the same hygenic treatment. The final result was quite as satisfactory without as with vaccine, in patients suffering with chronic arthritis and acute rheumatism. Further, he says patients suffering with *Streptococcus viridans* endocarditis were not benefited by autogenous vaccine. "Indeed, I believe some of them were made distinctly worse when moderately large doses of vaccines were used." He further says, "Based upon the work of Wright, but disregardful of the principles developed by him, therapeutic vaccination has progressed in this country into an irrational fad, which is intensified and made degrading to the medical profession, and harmful to the patient, by commercial greed. On page 15, he says, "The marked prevalence of aveolar abscess is not associated with the frequent incidence of systemic infection. Probably the frequent relation of pyorrhea to rheumatic fever, heart disease, nephritis and other acute local and general infections, has not been given the etiologic importance it deserves. Granting this fact, one must still recognize the comparatively small incidence of acute systemic disease arising from aveolar abscess." Dr. Billings' book, he tells us, is the result of "team work," and he uses the help extended to him by Ludvig Hektoen, E. R. LeCount, Edward C. Rosenow and others. He says, "These lectures, therefore, represent the cooperative study of many workers. I have made free use of the results of the labor of all who have aided in the work, and I am proud to be their spokesman." Thus we see that Dr. Billings' opinion on the value of vaccines in the production of immunity is of unusual value.

The most important reason given by Dr. Price and others for the removal of a pulpless tooth is the alleged inability to sterilize the tissues of the tooth. The dentin of teeth from which the pulp has been newly removed certainly cannot fall in this class; therefore, we may safely fill the roots of teeth from which the living pulp has been recently taken; the important consideration in this case being that all of the pulp tissues be cleanly removed from the root, under exquisitely aseptic conditions, and that the apical foramina be properly sealed. Teeth, the dentin of which have been permeated by bacteria from the pulp chambers, if the infection has not invaded the apical tissues beyond the tooth by the methods advocated and used by Rhein, Johnson, Howe, Callahan or Buckley, may be filled, with entire safety to the patient.[29] Brooks and Price corroborate the claims of Howe as to the possibility of sterilizing infected root canals by the formosilver method. Price now seems to have forgotten this fact. Price and

28. Billings, Frank: Focal Infection, p. 154.

29. Brooks, Matilda M., and Price, W. A.: Relative Efficiency of Medicaments for the Sterilization of Tooth Structures, J.N.D.A., 5: 273 (March) 1919.

Marshall,[30] have shown that the cementum cannot be reached through the dental tubules by sterilizing agents, and I draw your attention to the fact that, for the very same reason, infection cannot reach the cementum through the dental tubules. He says[31] "It is practically a physical impossibility, if not completely so, to sterilize infected cementum by treating through the dentin. It is like trying to sterilize infection in the label of a bottle by putting disinfectants in the bottle." It therefore follows that, if we securely block the path of infection through the apical foramen of all those teeth in which infection has not yet reached the apical tissues, we are absolutely safe in retaining them. I am equally uncertain of the value of all the results obtained by Price by the implantation of extracted teeth in the tissues of living animals. The object of animal experiments is to simulate in the animal, as closely as possible, the conditions that exist in the human being, as a result of dental infection, and if lesions are produced in the animal, to study those lesions in the light of the information obtained from the human being at postmortem, thus comparing the two. The tooth crown is never imbedded in the human tissue, except when impacted, and further, the tooth crown, as I have shown earlier in my paper, is always loaded with the infectious micro-organisms, which do not gain access to the tissues, under normal conditions. It is wrong to imbed the tooth crown in the tissues of an animal and expect the results of the infection produced thereby to be of value. To illustrate, let us take the following example. Rabbits used for experimental purposes usually weigh about 1,000 gm. This means a rabbit weighing 4 pounds. If we could study the human animal in the same manner, we would need to imbed in his tissues an infected object forty times the size of the infected object imbedded in the rabbit's tissues, to bring about a corresponding condition. The weight of the rabbit being 4 pounds and the human animal 160 pounds, it necessarily follows that the foreign body to be imbedded in the human being of that weight, in order to correspond to the imbedded tooth in the rabbit's tissues, must be forty times as large, and in addition to this the incision would needs be made through a skin covered with hair or fur, and full of bacterial life. At that perhaps the human subject could not provide exactly the same kind of laboratory experiment, nor is it likely that, after the experiment reached this stage, the conditions would be so bad as those surrounding the rabbits; for the latter slept and lived on the floor of a hutch, constantly saturated with their own urinary and fecal discharges. But suppose we could carry out the experiment on the human animal as Price carried out this experiment on his rabbits; we would need a large object equivalent to forty teeth in size, coated with streptococci, staphylococci and saprophytic bacteria; which certainly would produce an enormous abscess in the tissues, as well as, by their presence, causing injury and death, or consequent protein poisoning of a large area of tissue; and there would be introduced into the problem several factors which do not exist in the original problem, and which by their presence, would entirely alter and nullify the purpose of the experiment. To my mind, that

30. Price, W. A., and Marshall: J.N.D.A., 8: 327 (1921).

31. Footnote 15, p. 1474.

type of experiment would be just as sensible if we imbedded an amputated hand or foot in the abdominal wall of a man and expected to gain anything of scientific value by the experiment. For these reasons and many more, the bacteriologists, pathologists and research workers of this country look with extreme disfavor—I might even say scorn—on this type of work, which tends to bring the research work of the dental profession into an exceedingly unfavorable light among the scientific workers in immunology, experimental bacteriology and physiologic chemistry.

It has been said that the pulpless tooth is a dead tooth. This is not the case. The peridental membrane fiber of the pulpless tooth cannot be distinguished from the fiber of a living tooth. The nuclei and cell bodies composing this membrane take stain as sharply as do the nuclei and cell bodies of teeth containing living pulps. This, in itself, is ample proof that these teeth are not dead. This truth is substantiated by the work of Noyes and Hatton and is defended by Irons and others. Therefore, the only serious problem which confronts the dentist is as to whether or not there is a sufficient amount of infected cementum of that class in which the infection has passed through the apical foramen or reached the cementum through the blood stream to constitute a dangerous focus of infection. Perhaps there is no man at present living, in the dental profession who more clearly understands the pathology of dental infection and the dangers of focal infection than Meyer L. Rhein. I refer you to his article, "Mouth Infections and Their Etiology, and a Consideration of What Effect They May Have on the Vital Organs and Other Tissues,"[32] read at the Sixteenth Annual Session of the National Dental Association in Washington, D. C., 1912.

It gives me pleasure to state, in the year 1925, that Rhein's conclusions, drawn from his own experience and the literature comprising about 115 references, are as true today as they were in 1912. Notwithstanding the fact that Rhein has understood the relationship of mouth infection to systemic disease, he has, for thirty-two years, consistently filled the roots of pulpless teeth and preserved his records, which show a large percentage of successes, even with the teeth which have had granulomatous ends, which would, of course, mean that the cementum in the granulomas would be infected. This technic has been followed by Rhein since 1893, and I will give just one typical case in which before treatment there existed a severe arthritis. This case history was presented before the Clinical Congress of Surgeons in the city of Boston, 1916,[33] to show that secondary disease dependent on tooth infection may be safely overcome by proper treatment of the teeth. This patient, for one and three quarters years previous to Rhein's treatment, had been compelled to go on crutches. She had been Rhein's patient from childhood and her mouth had been in fine sanitary condition, so that the teeth were never thought of in relation to her disability. Finally, by good fortune, Rhein, by radiographic examination, discovered a granuloma involving the root end of a bicuspid tooth, with an absolutely perfect enamel and crown.

32. Rhein, M. L.: Dent. Cosmos, 54: 1237, 1912.

33. Rhein, M. L.: Surg. Gynec. & Obst., 22: 33 (Jan.) 1916.

Through an opening made in the crown, the root canal was sterilized and the tooth filled, the guttapercha extending through beyond the root end. The patient soon recovered and has had no return of arthritis during the succeeding years. She is still under observation. I cite this case because it is difficult, and because Rhein, in a paper[34] read before the Pathodontia Section of the First District Dental Society of the State of New York at the New York Academy of Medicine, April 26, 1921, tells us of both successes and failures, and points out the reasons for the failures. And this, by the way, is what constitutes honest research.

Through the courtesy of Drs. Johnson and Hinman of Atlanta, I have a series of case records to prove that secondary infection of joints disappear following the correct sterilization and treatment of root canals.

In the same category of pulpless teeth with granulomatous root ends, I have a series of cases in which root canal treatment has been effectively carried out, and in which serious joint and heart involvement has given way to all the evidences of perfect health. I will also say that I have had a series of failures, which have subquently required the extraction of the teeth I had attempted to save. Notwithstanding these failures, it is my firm belief and my great hope that the dental profession will never cease to attempt to save human teeth, not desisting in their efforts until they have, by skilful and patient observation, reached the conclusion that a tooth must and should be removed. I am convinced that, if we treat each individual case as a new problem, and if we give to each case the thoughtful, careful and skilful attention that we would desire if we were the patient instead of the physician or dentist, thousands of teeth that are now being sacrificed may be saved, and without the loss of a single life. We have justification for following this constructive therapy. It has been furnished by Johnson and Hinman, Rickert and Lyon, Edouard Hall of Kansas City, Howe, Ottolengui, Coolidge, Black, Logan, Buckley and Blayney. You men who are in doubt about the power of medicinal agents to sterilize dentin should reread Dahlgren's contribution[35] in which he shows conclusively, the drugs which can and do sterilize dentin.

Hyatt, in an interesting study of radiograms,[36] analyzes 2,787 films, making a study of (1) teeth with crowns; (2) teeth with nonvital pulps; (3) a percentage study of teeth with nonvital pulps; (4) conditions shown in roentgen-ray pictures which were not found clinically. These studies, made on teeth, which doubtless were filled before the profession felt the need of aseptic surgery, are of much encouragement. Black's tabulated studies also give encouragement. We should remember, in the consideration of this question, that the teeth which have been badly treated in the past are the ones which are furnishing most of the evi-

34. Rhein, M. L.: J. Dent. Res., 4 (Sept.) 1922.

35. Dahlgren, B. E.: Root Canal Problem, Asepsis and Sterilization, J.N.D.A., 4: 49 (Jan.) 1917.

36. Hyatt, Thaddeus P.: Study of 2,787 Radiographs Taken from 1,140 Patients During the Year 1916, in the Dental Section of the Metropolitan Life Insurance Company, J.N.D.A., 4: 594 (June) 1917.

dence on which our radical brethren base their opinions regarding conservative dentistry. Perhaps I could give no better evidence of the faith that is in me than to state that I have retained three pulpless teeth, and I know of no more sincere test of a man's honesty in the practice of medicine or dentistry than the willingness to take his own medicine.

Before I close I wish that you who have attached marked importance to Price's researches would give ear to Dr. Rickert's experience with the alleged toxins that Price says he obtained from the washings of crushed infected teeth. He shows a picture in his book, which is also reprinted in his debate with Buckley, of two brother rabbits. One, inoculated from the washings of a crushed infected tooth, lost 35 per cent in weight; while the control gained 15 per cent in weight. Rickert has shown that, in a series of rabbit experiments carried out exactly as Price carried out these, all gained in weight. The question of inherited susceptibility, of which a great point is made in Price's book, was completely nullified twenty years ago, and has many times been exploded since, by the fact that, in both animals and men, children born of mothers with active tuberculosis, if immediately removed from the environment of the mother, do not develop the disease. In the arguments made by Price for increase in heart disease, he mentions the fact that there has been an enormous increase in the number of deaths from heart disease in the city of New York since the year 1866, and he entirely neglects to show that the population of New York is several millions greater now than in 1866, when fewer deaths occurred. Diabetes is not on the increase. There are fewer deaths from diabetes. In the statistical bulletin[37] of the Metropolitan Life Insurance Company, we find the following: "The diabetes death rate declined to 15.1 per hundred thousand from 16.3 in 1923. The 1924 figure is lower than for any year since 1920, but nevertheless higher than for several years of the past ten. The drop in this death rate is one of the most hopeful items in the statistics of the year, for it shows what can be accomplished through the increasing use of the insulin treatment, when the tendency is all towards increasing diabetes death rates." There is no research work to prove that the islands of Langerhans, in the pancreas, are injured by tooth infection. There is, however, a great and constant increase in our starch and sugar consumption. We each now eat 87 pounds, according to our mortality statistics for 1922; and it is the belief of most men who think on this question that the increased incidence of diabetes mellitus of past years is due to the enormous increase in the use of sugar and other carbohydrates, which, in turn, is due to the fact that a dollar will buy more carbohydrate food than fruit or protein.

Dublin also states in the same bulletin that there is a decline in the death rate from degenerative diseases.

In order that we may not lose sight of the tremendous extent of the lymphatic system, which is rarely ever adequately mentioned in discussions of this sort, the lymph supply of a few areas of the body is here shown, that we may understand more clearly the tremendous army that contributes to our protection besides the white cells of the blood stream.

37. Bull. Metropolitan Life Insurance Company, January, 1925, p. 4.

Dr. Price brings the Caulk Dental Research Institute, gratuitously, into his discussion.[38] Some of his remarks made before the meeting of the Odontographic Society of Chicago, Nov. 11, 1925, have been deleted from the printed record, but there is still enough of suggestion in that portion of his debate relative to Caulk's products to make one wonder whether or not the fluid used to mix Caulk's root-filling material, and with which the profession is advised to flush the canals of teeth which are about to be filled, has a distinct germicidal value. I, therefore, placed 5 drops of a twenty-four hour broth culture of streptococci in each of two vials of this fluid, shaking well, and then transplanting from this fluid into fresh sterile culture mediums, at intervals of one minute, and I testify that no cultures grew as a result of these transplants; which shows conclusively that this fluid must have a positive germicidal value for streptococci. I am not interested in Caulk's products, but I am interested in knowing the truth or the falsity of the claim that this product has a germicidal value.

I should like it clearly understood that I do not approve of the retention of hopelessly diseased teeth, that I always insist on their removal. I should further like to say that I have absolutely no personal quarrel with any man in the practice of dentistry regarding this question. These facts and views which I have set down here are to be considered strictly from a scientific standpoint; for it seems to me that sentiment is entirely out of place in a scientific discussion.

It has been a privilege to discuss this question in a city which contains more men trained in dental science than perhaps any other, a city which was the home of the foremost research worker in the field of dentistry, whose word was a synonym for truth, Green Vardiman Black.

38. Footnote 15, p. 1473.

A CRITICAL REVIEW OF DENTAL FOCAL INFECTION FROM THE POINT OF VIEW OF HUMAN PATHOLOGY*

By EDWARD L. MILOSLAVICH, M.D., Milwaukee, Wisconsin

IN various fields of human activity, we may observe a sudden rise of ideas, which seem to develop like an avalanche, submerging the cultured minds of many who are unprepared and unconscious of the outcome—ideas which act suggestively on the multitude, holding them spell bound, and thereby preventing all further rational progress.

The realm of scientific and practical medicine is susceptible to similar currents of opinion, as well as to the advancement of the same short lived theories, which occur universally. From an enormous bulk of research work, literally an overproduction, a great deal

*Read before the Chicago Dental Society, Dec. 15, 1925.

of which is shallow, one single fact may be crystallized after many years of deliberation, one scientific achievement which may characterize that particular epoch as more or less valuable to the progress of science.

And thus we observe one problem after another holding the attention of the medical world, unintermittently. Only those workers who critically differentiate and assimilate the new theories, conscientiously pursuing their investigations without being influenced by the ambiguous statements of the enthusiasts, can hope to be successful.

Not so long ago, our entire interest was centered on the tonsils, to which were traced the beginning and the end of all bodily ailments. Exaggerations of every variety followed, attended, as usual, with the most absurd predictions. Consequently, in many cases, tonsils were removed without proper scientific indication, because of an apparent or a hypothetical danger. Only recently, during the short course of one year, more than 1,000,000 tonsillectomies were performed, seemingly as a result of autosuggestive influences exerted on the practitioners, who resorted to these radical methods without proper scientific reasons.

And now our present era is concerned with the general extraction of the teeth. The term focal dental infection was formulated and already influences every medical thought and activity. The patient fears his own teeth, the physician points to the teeth and condemns them and the dentist extracts the teeth on the least indication, all visualizing an imaginary enemy.

In order to understand the present-day situation regarding our subject, let us draw an analogy with the tonsillectomy craze. At that time, the same statements and promises were advanced, apparently founded upon the same observations and speculations, claiming and guaranteeing the same therapeutic results. The interest in the tonsils, however, lost favor, and in their stead the teeth have been attracting universal attention. And this particular interest is the reason for our gathering today.

Before entering on this specific discussion, permit me to say a few words regarding the conception of focal infection in general and the possibilities of its localization in the human organism. I should like to lay particular stress on the latter fact, since herein I realize one of the principal points in this subject, in establishing the most probable portal of entry for bacteria in the human body, in emphasizing the continuous battle between the tissues of the human body and the lurking micro-organisms on its external and internal surfaces.

Considering the human body, we can distinguish an outer surface, the skin, with the adjoining mucous membranes, and three internal surfaces; namely, the respiratory tubes, the entire digestive canal and the genito-urinary tract; vast internal surfaces, which comprise by far a greater area than the external surface of the body itself. And nearly all these surfaces are inhabited and besieged by innumerable micro-organisms, which, under normal conditions, live harmlessly upon the body, but which may invade and even destroy their host should the occasion present itself.

Let us first consider the upper respiratory system.

The nasal cavity must be regarded as a source of body infection, while we are speaking of the possibilities of focal infection, since it harbors a vast multi-

tude of bacterial flora of various kinds, most especially in cases of acute or chronic rhinitis in individuals who, more frequently than once a year, have a discharge of abundant mucopurulent secretions containing aggressive bacterial colonies. I call your attention to the condition of chronic hypertrophic rhinitis with cryptlike formations in the mucous surface and development of distended venous capillaries and vessels in the submucosa showing a cavernous type of structure. Such individuals are very susceptible to nose bleed, which produces lacerations of the epithelial covering. The act of sneezing or of blowing the nose may cause additional traumatism to or defects of the inflamed mucous membrane, thereby facilitating the entry of bacteria.

The ethmoidal region is frequently the site of focal infection. The many hidden depressions and pockets offer an advantageous cultural environment for bacteria of many varieties.

The accessory sinuses of the nose, such as the maxillary, the frontal and the sphenoidal sinus, are additional difficultly accessible and difficultly visible areas for infection. How frequently do we find metaplastic processes of the mucous lining of these cavities, which convince us that previously inflammatory conditions of long duration have existed there! How often do we encounter latent empyema of these bony cavities which is unnoticed by the patient and his physician! How often does a persistent, apparently incurable headache, with or without other symptoms, turn out to be an empyema of the sphenoidal cavity which has been completely overlooked! Some cases of cryptogenic sepsis are shown on the necropsy table to have originated in empyemas of the accessory sinuses of the nose which have not been recognized during the life of the affected individuals.

These facts you must first consider before you direct your attention to the existence of a pulpless tooth.

Have any of you ever undertaken the examination of the bacterial content in the pockets of the pharyngeal cavity and of the upper respiratory tract under normal conditions? Have you ever had occasion to observe the enormous and rapid growth of microorganisms in these places in cases of acute or chronic catarrh? Investigating these mucous membranes microscopically, you may witness additional proofs of a battle between the defending organism and the invading, generally victorious bacteria. This, however, is but the first stage of this microbiologic struggle, the struggle for the portal of entry. The next stage takes place in the regional lymph glands, the last barrier before the entire organism is invaded and conquered. The apparent evidences of this event are hyperemic, hyperplastic and exudative processes in the lymph nodes, until the bacteria, if successful, irresistibly find their way through lymphatic channels or blood vessels spreading into the entire body. And thus we not uncommonly find bacteremic conditions during the acute inflammatory processes (induced by different etiologic factors) of the respiratory organs. Such bacteremias may occasionally lead to metastatic foci of inflammation, immediately or subsequently. The acute affections of the respiratory organs may therefore act in the true sense of focal infection.

At times, however, the bacteria are retained in the regional lymph glands, where they may persist in a stage of chronic latency, as, for example, in

tuberculosis; or they may produce inflammatory reactions, as, for instance, suppurations with formation of glandular abscesses. Consequently, the lymph nodes of the upper respiratory tract are of vital importance from the standpoint of focal infection. Recently, on the necropsy table, on two different occasions, I found kidney concretions in individuals who were killed accidentally. The one was toothless, the other appeared to have healthy teeth. In both cases, however, I found chronic streptococcal abscesses in the inferior tracheobronchial lymph glands. I am convinced that, in the one case, the physician would have attributed the cause to the presence of the teeth, in the other case to the absence of the teeth, since the affection of those anatomically hidden lymph glands would never have been discovered clinically.

Having had the opportunity during the last four years to study microscopically more than 1,000 cases of removed tonsils, I am of the opinion that, in some cases, they may be carriers of focal infection. On the other hand, I learned to condemn the unnecessary, routine removal of these structures, since the tonsils represent an important part of the protective lymph-adenoid apparatus of the mouth.

It is remarkable how seldom we observe cases of fatal tonsillogenic septicemia and pyemia; how rarely we can rely on the pathologic findings in the tonsils during postmortem examinations in explaining the cryptogenic sepsis. There are usually inciting foci in other regions or organs of the body hidden from view, as previously mentioned, which we will consider briefly.

Let us now direct our attention to the intestinal canal.

The colon presents for resorption a large surface which is lined with a simple layer of very delicate epithelial cells and is inhabited by countless microorganisms of many descriptions. Disturbances in the digestive processes, in peristaltic movements, etc., may cause a rapid and abundant growth of the intestinal flora already so varied and numerous, which may affect different abdominal organs by ascending, or by traveling in the lymph or the blood stream, as well as inciting bacteremic conditions of mild or of severe character. Certain diseases of the bile duct system (cholangitis, cholecystitis, etc.) may be traced to these disturbances. The upper urinary tract may also be affected by conditions arising within the intestine (pyelitis).

I shall mention specifically the existence of the autochthonous flora of the cecum, which show not only individual fluctuations but also certain variations within different peoples and races (mode of living, environment, diet, etc.). The cecum can truly be called an excellent breeding place.

We should not forget that many interesting research achievements of the first decade of the present century, regarding the transmigration of the intestinal bacteria and the permeability of the normal and diseased intestinal wall in relation to infections of various kinds.

Should an enterologist today maintain that all infections can be traced to the intestine, so abundant with bacteria (enterogenous focal infection), he would have a far more plausible basis for discussion, a far more plausible working hypothesis than he who constructs an erroneous and harmful theory based on the presence of an apparently normal pulpless tooth. Meanwhile, no

one would attempt to eliminate the highly pathogenic bacteria which are ever present in the intestines. One pulpless tooth seems to be far more dangerous.

I shall refer briefly to infection of the genito-urinary tract, pointing out at this time those affecting the prostate, the seminal vesicles and the cervix uteri, and omitting the venereal infections. Every experienced gynecologist and urologist knows the obstinate catarrhs of these organs, which defy every therapeutic procedure and not rarely lead to general disturbances. In many of these instances, one may obtain *Streptococcus viridans* in pure culture or as a mixed infection. We therefore search in these organs for the source of focal infection.

After these brief and general remarks, I should not like to leave the impression that I am totally ignoring dental focal infections *a priori*. According to the analogy of the pathologic processes in other organs, I believe that gingival suppurations (pyorrhea alveolaris) and periapical dental abscesses may sometimes bring about metastatic foci anywhere in the body. I deny emphatically that dental affections, as a rule or solely, lead to metastases, while affections of other organs do not. Because of an almost daily experience of twenty years on the necropsy table, affording vast and varied material in morphologic investigations, I am convinced to the contrary.

What, then, was responsible for this universal idea of the danger of even an apparently normal pulpless tooth or of dental focal infection in general? The answer is simply this: The culturing of the extracted tooth, which is always contaminated. With these cultures, which usually contain a streptococcus of viridans or anerobic variety, the investigator performed animal experiments and apparently succeeded in introducing different kinds of systemic affections. Rosenow developed more than a dozen different diseases in animals with his specially trained streptococci. He claims that he is able to direct them into any organ of the animal body. Truly, Rosenow can be called a master trainer of streptococci!

Among other things, Rosenow and several of his followers maintain that they succeeded in producing in animals a typical peptic ulcer of the stomach by inoculating them with streptococci cultures obtained from the affected teeth of the patient suffering from the gastric ulcer. Fortunately I saw a picture of one of these stomach specimens during a lecture in Milwaukee two years ago. Gentlemen, this was not a peptic gastric ulcer, but multiple pyemic abscesses of the gastric mucous membrane, some of which were ulcerated; morphologically and histogenically a quite different picture! Regarding the other necropsy findings, we were not informed. Such proofs are incorrect and misleading.

In the animal, but particularly in the human, organism, the pyemic picture varies. The abscesses may occur in one or in many organs; in fact, only one abscess may be evident on gross examination. The localization of the abscesses depends not only on the general or transitory resistance of the tissues, on their metabolic chemical condition, but also on the fluctuating functional activity of the organ, on the varying blood supply and circulation, etc. While considering these conditions, before we point to a selective action, we must prove this selectivity in one and the same case repeatedly and throughout an

entire series. Furthermore, we must, by means of painstaking microscopic and cultural investigations of all the organs, eliminate beyond question any other bacterial localization.

Only an incomplete knowledge of human pathology can explain the erroneous statement that appendicitis is caused by dental focal infection and that chronic appendicitis can be cured by the extraction of one tooth which may have been found to be affected. I need not inform you that appendicitis is enterogenous in origin and that its development metastatically has not yet been proved conclusively.

I do not intend to tire you with additional facts: I hope that I will have another opportunity to analyze this question more fully at a later date.

In concluding, I wish to state one more point:

Should the dental profession accept and apply the theories formulated by Rosenow and developed by others regarding dental focal infection, we shall soon be confronted by millions of crippled mouths; we shall soon be a toothless nation. With the extraction of all teeth, there will be a gradual atrophy of the alveolar processes, and premature senility of the facial cranium will result.

Gentlemen, my discussions are based only upon human pathology and no guinea-pig research.

THE LABORATORY MYTHS AND TRUTHS REGARDING THE PULPLESS TOOTH*

By U. G. RICKERT, A.M., D.D.S., F.A.C.D., Ann Arbor, Michigan

I SHOULD have preferred to speak from a purely bacteriologic standpoint but I was aware that Dr. Hartzell would fully cover this field; therefore my discussion will be limited to another disturbing angle of the subject.

So many conflicting opinions relative to our problem have emanated from the recognized dental research laboratories that, as a laboratory investigator, one feels inclined to apologize for continuing the discussion from the experimental standpoint. On the other hand, there should be nothing discouraging about it to those familiar with the history and the controversial experiences of medical research. We must bear in mind that dentistry, until about fifteen years ago, was but little more than a mechanical art, and that, about that time, as a result of Hunter's work, we stood in a new light, conscious that a new era had dawned in dentistry. We were no longer concerned only with thirty-two teeth, but with the general health of our patients. While the previous biologic training and education were inadequate in view of the newer requirements for the development of competent research workers, be it said to the credit of dentistry that such requirements were in a short time nearly doubled, and the profession itself en-

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gaged in organization and study unparalleled in its previous history.

With the newer knowledge of dental responsibility, it could well have been anticipated that many tempermentally and technically unfitted persons would, with the best of intentions, become fascinated with the attendant research problems. From the point of view of research, there were several grave miscalculations. If any one single factor is more responsible than another for the present vacillating attitude in the management of pulpless teeth, it is the erroneous idea that anyone with visions and dreams and the necessary ambition can employ technicians and direct research. Past experiences lead one to suspect that too often such laboratory assistants have been carried away with the enthusiasm of the director and have accomplished what they were hired to do; that is, to verify the opinions and hobbies of their employers; so that much valuable time has been sacrificed by the more painstaking workers who tried to verify such results. This has been especially true when the director has been of high standing and influence in the profession. Now that the majority of the premature bombs have exploded, and others are probably still in the act of exploding, we believe that there will be less rainbow chasing, and more fundamental and original work. We insist that dentistry is on trial and that our problem is a serious one, demanding not a destructive but a constructive solution. As a profession, we must encourage more competent research, and discourage the one-sided investigations intended only to prove that we are dealing with a hopeless problem.

We will now attempt to present a few of the myths that have emanated from some of the dental research laboratories, and that have been responsible to a marked degree in the development of the present confused mental attitude toward the subject. The first, a most damaging statement, came from a Western laboratory. It insisted that all pulpless teeth regardless of methods of treatment became infected in six months or less. This unwarranted and destructive teaching was not only broadcast too freely through both medical and dental literature, but was also given in synopsis in some of the supposed scientific columns of the more popular magazines. We have carefully cultured thousands of teeth and frankly admit that too many are pathologic. More than half of the teeth we cultured were infected. This does not prove that half of all pulpless teeth are seriously involved, because the mass of patients who are well are not submitting to the culturing of teeth. Our cases came chiefly from patients in whom there were reasons to suspect infection. Even if 75, 80 or 90 per cent of all pulpless teeth were infected, it would still be most damaging teaching to say that all were infected. It is those without disease that are of interest to the constructive research worker; for it is his task to find the factors that prevented infection in the later cases and, from them, to formulate the essential fundamentals for development of constructive operative and technical procedures.

A second myth, much spoken of in dental circles in the recent past, insisted that dentin once infected could never be sterilized. We do not know who is responsible for the teaching, but we do know that the originator never came to that conclusion as a result of painstaking investigations. The facts are that, unless there is present sufficient diffusion from the surrounding tissue, the

dentin becomes sterile even in the absence of antiseptics, just as cultures become sterile in the laboratory incubator. Unless there is a renewal of pabulum and a removal of the resultant end-products, organisms become inactive. Primarily, we are more especially concerned with the amount of diffusion possible. Fortunately, the normal cementum of a fully developed root reduces such diffusion to a negligible amount, with the exception of the apical end. In this region, diffusion can take place from the enveloping tissue through the cementum and dentin to the root canal, especially if the liquefied canal contents are continuous with the periapical tissues. Experiments in our laboratory have demonstrated that diffusion becomes negligible in most cases if the apical end of the canal is thoroughly sealed. The extent of open system cementum and dentin from the apex toward the gingivae can roughly be observed in old cicatricial quarantines or granulomas. We have here an attempt to wall off that part of the apical end permitting sufficient diffusion for continuous insult to the adjacent tissues. For this reason, successful root resections must include all of that part of the root end. In fact, this is the only way to manage successfully many of the chronically and extensively involved teeth. If all the cementum and dentin were as susceptible to diffusion as that near the apex, it is doubtful whether pulpless teeth could long be retained.

For some time, we have been told that even 40 per cent formaldehyd will not sterilize cementum. I asked the author of the statement for the experimental evidences, and the technic and results were outlined by him as follows: A tooth was selected and opened throughout the whole canal, to and through the apex. A funnel was cemented into the orifice and the middle part of the root protected with two rubber dams. The portion between the dams was inoculated with organisms and then 10 c.c. of solution of formaldehyd (U. S. P.) was permitted to pass through the canal from the funnel to a container below, after which, cultures between the two dams were still found active. To anyone familiar with the histology of cementum, the results could have been foretold. No one, as far as I know, would expect the germicide to pass through the cementum in this region of the tooth. Neither do we know of anyone treating abscesses so located. We feel justified in extraction for the few pericemental abscesses we find. To those who have wondered whether it was the test tubes or the experimenters that erred, with the many opposing opinions resulting, it must be evident that, in this case, both told the truth but the conclusions of the operator were at fault.

Another laboratory myth that will not bear too close inspection is that filtered infusions made from the crushed dentin of extracted teeth will, under certain conditions, produce toxemias if injected into laboratory animals. We have all, many times, seen the picture of the rabbit that steadily lost weight and died on the sixteenth day after the injection of an infusion taken from a tooth of an emaciated patient who also had been gradually losing weight and strength. We have selected patients presenting the same clinical pictures and have extracted all pulpless teeth from such patients and made infusions in accordance with the private instructions given by the original investigator, with even added precautions; but, in all instances, the half grown

rabbits used for the experiments gained in weight and showed no ill-effects from the injected infusions. We would not have you infer from this that we are recommending it as a valuable tonic because the gain in weight of the young laboratory animals was due to normal growth. It is generally known that, with the exception of certain strains of hemolytic streptococci such as that encountered in scarlet fever, streptococci generally are not toxin producers, but to us it occurred that some proteolytic changes might be at work within the tooth structure producing toxic material after traumatization of the periapical tissue into which such material diffuses. There is abundant clinical evidence that something of the kind may be taking place, but we, as well as two other investigators, have tried to duplicate the original experiment and have failed in every case; so that, in our opinion, it would be unfair to use this conception at the present time as an argument against the treatment of teeth.

We have still another myth that will not bear too close investigation. We are told that the principal of a number of root canal fillings that are on trial at the present time, including elements intended to inhibit approximate infections, are contraindicated because, in the laboratory, it can be shown that certain organisms may adapt themselves to increased concentrations of powerful germicides. Now, there is nothing new about the possibility of increasing the tolerance of the organism to certain of the germicides, but it has not been proved that the conditions required in the laboratory for the development of such tolerance are like those presented in actual practice as related to our subject. In order to verify this statement, we have taken from actual cases a few teeth that have been treated for some time with such root canal agents and have removed the filling material later and cultured it, with negative results. In order not to subject patients to unnecessary culturing and still get the necessary information, we have had laboratory teeth filled by some of these methods in which the root canal filling material included the inhibitive agent, and we have placed such teeth in culture mediums inoculated with many strains of streptococci actually taken from cultures of infected teeth. These teeth were frequently placed in freshly inoculated bouillon and, at thirty-day intervals, the root canal fillings were cultured, with negative results in practically all cases. The criticism might be made here, of course, that such root filling material might be, in reality, injurious. The facts are that we are not as yet advocating dependence on this type of root filling, but all observers have repeatedly seen cases in which this type of filling in the very crudest of combinations has given apparent service, comparatively well if not better than has been observed in methods more generally approved.

The charge that organisms existing in proximity to such fillings increase in virulence has not been satisfactorily studied in our own laboratories, but is under investigation at the present time. We do grant that this part of the statement might prove correct. We have been for some time taking cultures from the teeth of young patients with large open apices with continuous seepage, in which we were unable to get negative results from treatment. Cultures are taken at intervals to see if there is an increase of virulence of the organisms in the presence of the germicides we continue

to use in the canal. This will give us information of an actual and a practical application.

We hope later to present our results. While we could go on indefinitely with a presentation of laboratory fiction, we believe that enough has been said to demonstrate to the clinician that it is not the microscope or the test tube or the reagents that tell us one thing at one time and place, and another at another time and place; for these agencies are not handicapped with prejudices or preconceived ideas, but may be depended on to tell the same story anywhere in the world under uniform and standard conditions. We would not have you lose faith in the reliability of the laboratory: it is rather our desire, as students of the laboratory situation, to be helpful in the evaluation of experimental results. In studying reports, it should be remembered that the true scientist presents data and generally avoids elaborate interpretations and conclusions. He presents all the facts and technical procedures, step by step, so that other investigators can verify his results. If one follows the technical procedures of such men as Folin and Van Slyke, biologic chemists, it can be done with ease and accuracy, just as one would follow an accurate log of an automobile route. This has unfortunately too often not been true of dental research. I do not wish to give a pessimistic view of this experimental work, for while it is still in its infancy, we have already been presented with many scientific contributions. Then, too, we should bear in mind that, when a research worker has once become convinced of the truthfulness of one side or another of a controversial subject, and has announced his results as a finality, he may be right; but his services in this field of study are, as a rule, at an end; for from then on, too often, his labors are directed toward substantiation of earlier statements. It is only when laboratory results prove to be in harmony with large and long clinical experiences that the clinician may safely depend on them, for clinical experience still offers the most reliable course for practical application, and I say this as a laboratory worker; for I want my work to stand both the laboratory and the clinical test, otherwise the work is not finished.

Finally, it is my opinion, from an extensive study of all the authentic laboratory evidence, that there is no justification for the conclusion that we are dealing with a hopeless problem. Neither is it hopeless from the clinical standpoint, where our ideal can be accomplished. But the high percentage of root-filled teeth that have been proved to be infected is certainly convincing evidence that we must either improve our methods, so as to substantially reduce subsequent infections, or else our consciences should demand that we abandon the practice. This condition deserves our immediate attention. The most outstanding accomplishment of the laboratory is that it has, in conjunction with clinical experience, proved beyond a doubt that infected teeth are at times initiating, more often contributing, factors in some of the more serious systemic involvements. But if there is any lesson that we should accept from the experiences of medicine, it is conservatism. The medical profession, too, went through a period when a part of their membership advocated the removal of almost everything removable. Promiscuous extraction will not solve the problem because it has already been rather definitely proved

that the very patients who are susceptible to infections of inadequately treated pulpless teeth are also susceptible to pulp changes under restorations often producing degenerations that result in metastatic infections. We have frequently observed cases in which, in our zeal to remove a focus of infection, we have removed a tooth and temporarily deferred the infection only to have later, under the restoration, two foci where we originally had only one.

We all realize that prevention is the hope for the future, but even the most optimistic workers in this field admit that many generations will come and go before, as a result of their work, our problem will be noticeably effected. There is every reason to believe that pulp involvement will be a problem until some safe and suitable means of treatment is found for the management of at least the most evidently operable cases.

The time has come when, in self-defense, we must either develop a sort of rational Liberty Motor technic in accordance with standards set by the best opinions of all the allied sciences bearing on our subject, or else we must admit defeat in the first real surgically difficult test of biologic significance with which we have been confronted. Such defeat the sanity of dentistry will never permit. The most refined technical procedures of general surgery were not developed in a day, nor in seven days. It has been but a few years that the seriousness of the problem has been actually proved. With time, and a united front, we will find a constructive solution. Rational therapeutic and technical procedures for the management of teeth with involved pulps have never been tried on a large scale. The study of this problem, more than any other factor, supplied the inspiration for the recent phenomenal development of dentistry. Why throw up our hands now? We must anticipate, as surgery has done, that, during the development of the greater service, some patients may be inconvenienced. This cannot be avoided, for we are not thinking in terms of the day only, but in terms of science and the ages.

FOCAL INFECTIONS IN RELATION TO SURGERY*

By CARL BECK, M.D., Chicago, Illinois

EVER since the discovery that many diseases of the human body are due to the invasion of micro-organisms, the word infection has been a common term even among laymen, displacing the old term "blood poisoning." It was Frank Billings who, in his memorable Lane lectures, called special attention to focal infection. In an excellent monograph, he elaborated on many examples and results of research, pointing out the fact that the invading micro-organism choses certain ports of entrance and, through those, feeds into the body formed and chemical toxic elements, by way of blood and lymph, with deleterious effect. Because of his con-

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vincing arguments and the weight of his authority, a general movement began to attack the focus wherever found.

Tonsillectomy and removal of infected teeth began on a large scale, and indications for these operations became broader and broader. As in everything that is good, the benefits resulting from these operations soon were exaggerated—the pendulum swung too far. A reaction set in and now we are confronted with a struggle to settle scientifically the question "What is the truth about focal infection?"

The fact that a harmful poisonous matter enters through some wound or through some point of predilection, the tonsil for instance, spreads quickly through the body and causes disease and pathologic changes in distant portions of the same was known for centuries. Hippocrates, Celsus, Hildanus, Fabricius, Ambroise Paré, Morgajni and all their followers cite many cases of such results, proven by experiences in post-mortem examinations and proven in operations. It was Ignaz Sommelweis, of Budapest, who gave the first impulse to scientific research in focal infection by his observation that puerperal fever was due to infection during childbirth introduced into the body of the mother and that by excluding this focus childbirth could be made safe. Lord Lister was another pioneer in the discovery of this important fact, pointing out the infection of wounds and its prevention and cure. Pasteur showed the direct connection of micro-organisms and infection. Not only the knowledge of these facts, but also the cure of infectious conditions by removing the original focus is well-known in history of medicine. But it remained for the most modern science to develop a theory that diseases of the body and symptoms of disease of organs may be due to insignificant, apparently harmless foci, which were hitherto unsuspected or overlooked, yet were the real cause of the disease; that a harmless looking crypt in the tonsil may produce a goiter with *foudroyant* symptoms, or that a slight inflammation of the root of a tooth may be the focus responsible for endocarditis, with acute rheumatic inflammation of the joints, or the causative factor of an unbearable neuritis.

This new aspect of focal infection made us aware that a treacherous, but not active otitis media (middle ear suppuration), without symptoms, might be the cause of many diseases. Dr. Watson Williams, of Bristol University, finds middle ear disease causing remote symptoms in six different conditions: neurasthenia, loss of general health, myalgia, mental changes, epilepsy and acute interstitial nephritis. Goiter due to focal tonsillar infection is of common occurrence. That diabetes may be due to focal dental infection and disappear with the removal of the teeth, and that osteomyelitis and many other ailments are often due to focal infections and do not disappear until the focus is done away with is the report of many reliable observers. On the theory and proof of it follows the categorical demand for action. For instance, Sir William Wilcox states; "Any focal sepsis should be dealt with by appropriate surgical measures." Suppose we have a case of arthritis deformans. We do not know its cause, but we find that the tonsils are in a condition of chronic inflammation. When the tonsils are inflamed, they may be a cause of the arthritis. We do not know whether they are the cause in this case, but removal of the focal sepsis is indi-

cated. It is believed that, after tonsillectomy, the arthritis will disappear. But will it? Upon similar logic, hundreds of tonsillectomies are performed. Let us take another case: A man of 50, suffers from general malaise, gastrointestinal disturbance. Fluoroscopy does not reveal any gastric or intestinal changes, but some of the teeth are defective, and roentgen-ray films show clearly pathologic changes of roots; therefore, these changes may be the cause. The teeth are removed and now we expect the patient to be relieved of his symptoms. But is he, and if he should be perchance, would that prove that the dental condition was the cause of his illness? The symptoms remain the same and "the patient is greatly annoyed by having to use plates." In the course of time, it is found that an enlargement of the spleen explains the disease. The physicians in this instance, as often occurs, failed because they made use of the wrong logic. Because defective teeth, pulpless teeth or root *abscesses* may cause a disease, it does not follow that they caused this disease.

One of the most dangerously illogical conclusion is embodied in the phrase "*post hoc ergo propter hoc*," which means because something follows some action, it must be caused by that action—or cause and effect are always timely, succeeding each other. If it rains, the pavement is wet: the pavement is wet, therefore it must have rained. We apply a remedy and the disease disappears. What is more natural to the mind not trained to logic than to think that the remedy has cured or done away with the disease. That is not proven. The disease might have disappeared without application of the remedy, and the remedy might have had nothing to do with its disappearance. Some one has a tooth pulled, and, a few days later, some unfavorable symptoms disappear, and the dentist and the patient think that the disease was cured by the extraction, and the enthusiastic patient lauds the dentist, who begins to apply this remedy in many other cases.

There are indeed many instances of real casual connection between focal infection and secondary disease, and in such instances the effect is the removal of the focal infection, with prompt recovery.

It is not only the duty of surgery to remove the focal infection, the cause of the disease; it must also remove the effect. For instance, a gonorrheal infection of the urethra may lead to the formation of an abscess in the fallopian tubes or a pyelitis, and the removal of the primary focus will not cure the disease, the primary focus must be removed, and the result of the focus, the pyosalpinx, clearing away the pyelitis. If the primary focus is not cured, the secondary inflammation will continue. There are numerous instances of spontaneous disappearance of symptoms with or without therapy and pathologic changes. Nature heals the disease, and osteopathy, chiropractic or Christian science has such experiences and claims success, not to mention the many operations and medicinal treatment which had nothing to do with the cure except as regards coincidence or sequence. Every physician has "luck," only he seldom acknowledges it to his patient, it is the *post hoc ergo propter hoc* conclusion.

What is worse, however, is the fact that the enthusiast, after such experiences, often comes to believe himself in the efficiency of his remedy, and thus we see the field of an aggressive surgery extended for all kinds of ailments

which might be caused by focal infection, and gradually it may be recommended for all diseases—it becomes a panacea. The claims are made that a carcinoma, goiter or insanity may be cured by the same remedy. Science is thus greatly injured and a good thing is discredited.

What is the remedy?

1. A cool dispassionate and disinterested discussion of the facts.

2. Insistence on scientific diagnosis and indications for any surgical procedure including trivial operations for focal infections, such as extraction of teeth, until casual connections between focus and effect or symptoms is established. Unfortunately, the diagnostic tests are far from perfect.

3. Let us not obstruct, but on the contrary, further research, so that we may find reliable tests for determining the connection between focal infection and the symptoms of disease.

4. Let us give to the public only such finely seasoned truth as coincides with our knowledge and is not based upon theories. The public still trusts some physicians, but it is dangerous to give to the public without an accompanying critical estimate results of theoretical conclusion and scientific facts.

REGENERATION OF THE APICAL REGION AFTER TREATMENT AND FILLING OF THE PULP CANALS*

By EDWARD H. HATTON, B.L., M.D., Chicago, Illinois

IF pulpless teeth were dead teeth, there would be no pulpless tooth problem, and there would be no regenerations of the apical region both within and without the apical canal after the treatment and filling of the pulp canals of such teeth. There would be no pulpless tooth problem because such teeth, like replanted teeth, which are typically dead teeth, would be rapidly absorbed and exfoliated in nearly all instances. If regeneration of the apical region can be shown after treatment and filling, it is significant, demonstrating that teeth having such regenerations of the apical region have not yet lost their vital attachment and relationship to the investing tissues and to the body, and, therefore, are not dead teeth.

Regenerations of the apical region of teeth, the root canals of which had been treated and partly filled, were demonstrated first by Witzel, about 1873. Recently, in this country, Davis and Grove have made similar demonstrations. The same criticism applies to the work of both Witzel and Davis; namely, that they attempted to prove that these regenerations were a direct result of pulp amputation, and they used their specimens as propaganda to popularize this method of treatment. The same criticism should be applied to a more thorough study of a more extensive material, including animal teeth, by a group at Zurich, Switzerland. I feel that this has been extremely unfortu-

*Read before the Chicago Dental Society, Dec. 15, 1925.

nate, for it has focused our attention on the relatively unimportant region of the middle third of the pulp canal, and taken it away from the region at the apex; and it is in this part of the tooth, I am sure, that the changes are to be found which determine the final result. Grove is to be praised for focusing our attention on this region, and to be condemned because of his claim that only if the filling is brought to the junction of the cementum and dentin does a satisfactory regeneration occur. He has not seen that regeneration depends not so much on the perfect attainment of this requirement of a good root-canal filling as on the condition of the apical cementum at the time that treatment is undertaken.

Skillen and I and our students have repeatedly called attention to the importance of the condition of the apical cementum. We do not claim originality for this belief: Black, Noyes and others had made similar observations. Gottlieb, of Vienna, is doing a tremendously important work at the present time on the changes in cementum the result of disease or altered function, and is constantly emphasizing the part played by the cementum in the production of pathologic conditions, here as well as at the neck of the tooth.

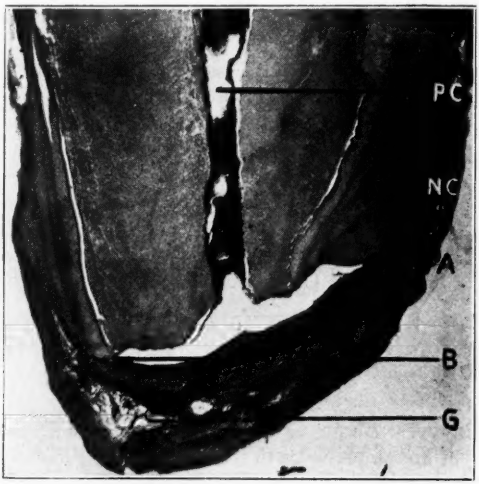

Fig. 1.—A longitudinal section of the apex of a tooth having a small encapsulated periapical infection, with extensive denudation of the apex. *PC*, pulp canal filled with purulent material; *NC*, new layers of cementum; *A* to *B*, extent of the denuded root end; *G*, encapsulated periapical infection (granuloma).

We are satisfied that considerable areas of necrotic and denuded cementum are never replaced, and that the the apex of a tooth with a considerable zone of denuded and necrotic cementum is restored, if at all, only in exceptional instances. The favorable result of treatment is, therefore, determined, not so much by the form of

treatment used as by the conditions at the apex of the tooth treated.

Further, we have said, and still say, that the presence of infection in any region cannot be determined solely by bacteriologic methods. The presence of bacteria anywhere in the body does not necessarily indicate infection; there must be a reaction between the tissue cells and bacteria. On this account, we maintain that the only sure method by which to determine infection at the apex of a tooth is the anatomic; either a study of the gross anatomic condition or a similar study of the microscopic conditions around the apices of the teeth in question.

Using microscopic anatomic methods, we have been able to demonstrate that many human teeth that have been treated and filled are without histologic evidence of infection. But not only this: we have been able to demonstrate, in part, both the steps in the progressive involvement of the periapical tissues in infection and those in the healing of this region after treatment and filling of the pulp canal.

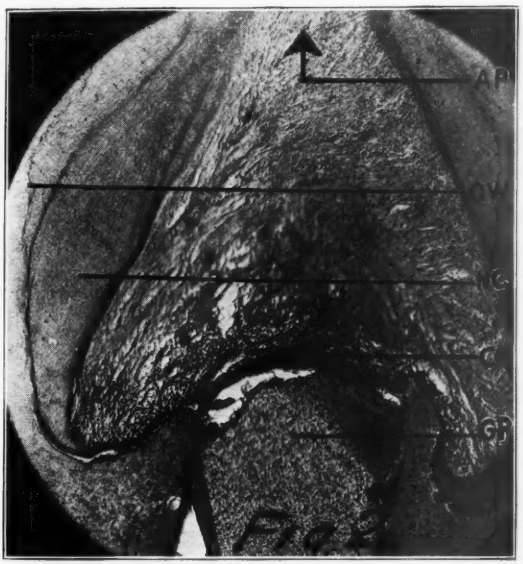

Fig. 2.—A longitudinal section of the apex of a tooth that has been treated and filled with guttapercha. *AP*, regenerated apical pulp; *OW*, old wall of pulp canal (postabsorption); *NC*, new cementum; *CC*, connective tissue capsule between guttapercha and the new pulp; *GP*, guttapercha.

In the mass of material that we have examined, there are many instances in which healing has not occurred. The reasons for this are usually very obvious; namely, selection of unsuitable cases; the presence of persistent or introduced infection, or inexcusably poor technic in carrying out this operation.

We and others have repeatedly emphasized these causes of failure.

We feel that this problem is no longer our problem except as it concerns relatively unimportant details. This problem now belongs to the practicing dentist. Can he develop an accurate, aseptic, scientific technic for treating and filling root canals upon the basis of a thoughtful selection of cases that will yield a high percentage of satisfactory results? We have proved that it can be done; and it is now your duty to carry on and to demonstrate whether or not this procedure is to be discarded except by unusually capable and conscientious practitioners, or to be reestablished in general favor.

I cannot at this time definitely answer the question, "Should practically all pulpless teeth be extracted?" But this question will be answered by your reaction to the facts as stated in the foregoing paragraphs. My interpretation of these facts leads me to the belief that such teeth are crippled or handicapped teeth, but not dead teeth; and therefore, we should avoid as far as possible making teeth pulpless; but the reasons for the extraction of teeth are essentially the same whether the teeth are with or without pulps.

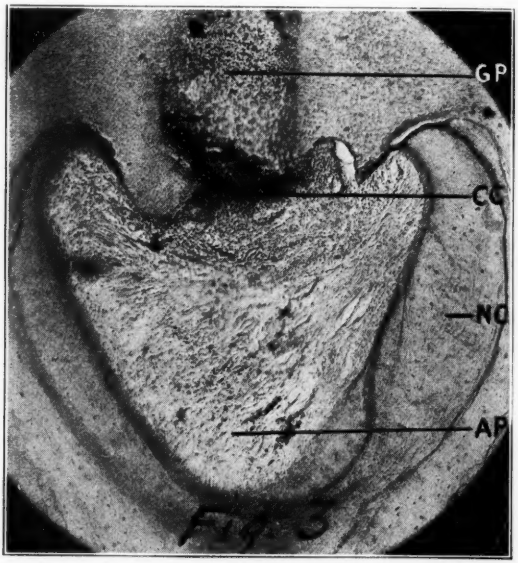

Fig. 3.—This is similar to Figure 2, except that the process is at a more quiescent stage. The canal is not actually closed at the apex—the apparent closure is due to the angle of the microtome cut. *AP*, regenerated apical pulp; *OW*, old wall of pulp canal (postabsorption); *NC*, new cementum; *CC*, connective tissue capsule between guttapercha and the new pulp; *GP*, guttapercha.

SOME UNKNOWN FACTORS IN THE PROBLEM OF THE PULPLESS TOOTH*

By FREDERICK B. NOYES, A.B., D.D.S., D.Sc., F.A.C.D., Chicago, Illinois

FOR some time, I have felt that what the question of the pulpless tooth needed from the dental profession was more work and less talk.

Young men coming into the profession are sometimes inclined to feel that there is nothing more to be done—that the great problems have been solved—the great works accomplished. In reality, one can scarcely begin the study of any subject in dental histology and histopathology without finding himself on the frontier of science, in the borderland between the known and the unknown, where thoughts and opinions are changing as if in a state of flux. Each new fact discovered, each additional piece of work recorded has its influence on the truths that will crystallize out of the molten mass.

The structure of the dentin and the contents of the dentinal tubules is an important factor in the consideration of the subject under discussion, but it is surprising how little is known about it and how often inference and hypothesis have been mistaken for fact and used as such in the present discussion. The structure of dentin may be outlined as follows:

1. Contents of dentinal tubules.
   (a) Cystoplasmic contents and relation to matrix.
   (b) Infection of tubules and their part in retaining and spreading infection.
   (c) When and to what extent the tubules are filled with micro-organisms. (Comparison between a pulpless tooth and an extracted tooth soaked in infectious material.)
   (d) What becomes of the contents of the dentinal tubules.
2. The relation of dentin and cementum.
   (a) Question of a communication between them.
3. Question of infection of cementum in apical infection.
4. Regenerations occurring in the apical region and their result.
   (a) Infection.
   (b) Amputation.

I want to repeat that what is needed in the solution of this problem is a great deal of hard honest work that is not undertaken to prove that all pulpless teeth should or should not be extracted, but to find the truth which will enable members of the profession to judge within the limits of their ability which teeth should and which should not be extracted, just as the doctor must judge whether an arm should or should not be amputated.

*Read before the Chicago Dental Society, Dec. 15, 1925.

WHAT IS THE ARBITRATION SOCIETY OF AMERICA?

The House of Delegates of the American Dental Association at Louisville last September passed a resolution charging the Judicial Council with the task of familiarizing the members of the Association with the principle of arbitration, and cooperating generally in the development of the arbitration movement.

For the information of the Council, Dr. Thaddeus P. Hyatt of New York submitted an article on "Arbitration versus Litigation," which is published herewith, and is commended to every member of the American Dental Association for careful reading.

The Sixty-Eighth Congress of the United States passed an act to make valid and enforceable written provisions or agreements for arbitration of disputes arising out of contracts, maritime transactions or commerce among the states or territories or with foreign nations.

New York, New Jersey, Oregon and Massachusetts have enacted Commercial Arbitration laws.

The Arbitration Society of America, Inc., 115 Broadway, New York City, operates in conformity with the New York law and is open alike to trade organizations, firms and individuals.

Its purpose, briefly stated, is to extend nationally the principles of the Arbitration law of the State of New York by means of education, legislation and cooperation and to foster the settlement of commercial controversies by means of arbitration with the least possible delay and at a minimum expense.

The Arbitration Society of America will send, on request, without charge, to anyone interested, literature on "Commercial Arbitration in the United States; Laws and Procedure;" also the "Plan, Purpose and Achievements of the Arbitration Society."

Your Council, in order that it may learn and to the best advantage familiarize the members of the American Dental Association with the principles of arbitration as promulgated by the Arbitration Society of America, Inc., urges any member who may have information relative to this subject or a good argument for or against the proposition of the American Dental Association's affiliating with the Arbitration Society, to do as Dr. Hyatt has done, viz; write a brief article on the subject and forward it to THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION or to the Chairman of the Judicial Council, 59 E. Madison Street, Chicago, Illinois, where it will receive due consideration.

Most sincerely,

G. WALTER DITTMAR, *Chairman,*

Judicial Council, American Dental Association.

ARBITRATION VERSUS LITIGATION

By THADDEUS P. HYATT, D.D.S., New York City

At the meeting of the House of Delegates held Thursday, September 24, 1925, the following resolution was presented and unanimously adopted:

WHEREAS, it is generally recognized that the congestion of civil court calendars and the technicalities of litigation are defeating the prompt administration of justice and are imposing an unjust burden of cost and hardship upon all parties involved, and

WHEREAS, disputes arising out of business transactions may be determined speedily, economically, efficiently and with finality through arbitration before arbitrators selected by the disputants themselves, and

WHEREAS, it is to the mutual advantage of dentists and their patients to settle amicably and without the annoyances of litigation any disputes that may arise between them, and

WHEREAS, the Arbitration Society of America is conducting a campaign of education throughout the United States to promote the more general use of arbitration among the members of the recognized professions as well as among business men generally and is operating a public tribunal for the arbitration of actual disputes, be it therefore,

Resolved, that the American Dental Association, in convention assembled at Louisville, Ky., heartily endorses the principle of arbitration and the plans, purposes and activities of the Arbitration Society of America and requests formal affiliation with said Society; be it further

Resolved, that the House of Delegates authorize the standing committee on judicial council to familiarize the members of the American Dental Association with the principle of arbitration and to cooperate generally in the development of the arbitration movement.

The two greatest evils to which the professional man is subject are wastage of time and damage to his professional standing through unfortunate publicity. These evils become very real whenever such a man is forced into litigation as plaintiff, defendant or even witness. As a result, he suffers when he is forced to go to court, and he suffers because of his wish to keep out of court if possible. For these reasons, he should be ready to give serious consideration to any intelligent alternative to litigation as protection for his rights, and such consideration has, by vote at the recent Louisville Session, been directed toward an investigation of the principles and practicability of commercial arbitration.

It is a significant commentary on American civilization that a certain and by no means inconsiderable amount of litigation is accepted by business as a matter of course. Even if the chief executive of a concern has to cool his heels in court while the mills of justice grind slowly, the wheels in his factory and on his delivery trucks continue to turn as usual. Having to be in court is a generally acceptable excuse for breaking an appointment; it implies no odium, inspires no expressive lifting of the eyebrows.

But, to complete the commentary, take the case of a professional man in court. It matters little whether he goes there as a plaintiff or is hailed there as defendant or witness. The court sits only during business hours and pulls the certified accountant from his books, the architect from his drafting board, the surgeon from his operating theater, the dentist from his chair. The wheels in the offices of these men must slow down considerably or even stop while

the mills of justice are slowly grinding. And the high ethical standards of these professional men and their particularly personal relations with clients or patients make an appearance in court, where they may be subjected to the innuendoes of none too scrupulous cross-examination, a painful experience and all too frequently an unmerited strain on the goodwill and confidence of their following. This is in fact a real public tribute to the professional code, but it is a tribute for which the individual must often pay an excessive price.

Public opinion is beginning to assert itself effectively on the twin evils of litigation and court delay. Business is awakening to the truth of the Department of Commerce's statement: "Next to war, commercial litigation is the largest single item of preventable waste in civilization; wars, however, are most sporadic and localized, while litigation is continuous and universal. . . . As a remedy to this condition, arbitration stands supreme. Human mind has not devised a solution more logical, satisfactory or efficient."

The Arbitration Society of America was organized more than three years ago to focus this opinion and apply it effectively in promoting necessary legislation and in developing a general use of arbitration. In this period, New Jersey, Massachusetts and Oregon have enacted enabling legislation similar to the pioneer New York law, and a Federal Arbitration Act will become effective, January 1. A score or more of other states make some statutory provisions for arbitration, but, in most instances, the enabling legislation does not make the use of arbitration certain and fully effective. The motion picture industry has adopted arbitration as the official method of settling all disputes between producers and exhibitors, and all controversies between members of the Actor's Equity Association and the managers are handled in the same way. Chambers of commerce and trade associations have set up the simple machinery necessary for handling arbitrations among their members and even between members and nonmembers. Among the professional associations which have endorsed the principle and are developing the use of arbitration are the American Institute of Accountants, the American Institute of Architects and several national societies of engineers. Recently, the Arbitration Society of America successfully handled the arbitration of a dispute between a prominent New York surgeon and a patient.

To the delays of the court calendars, the unfamiliarity of judge and jury with technical information and professional practices, and the menace of further delay through appeal to a higher court, the following alternative is now offered by commercial arbitration: The disputants state their respective claims in a joint submission to arbitration. They then agree on an arbitrator or a board of three arbitrators. In either case, this arbitral factor is of their own choosing, the basis of selection being competency to understand the facts involved and to render an intelligent, as well as impartial, award. A hearing is arranged for a time and place convenient to all parties concerned. At this hearing, the procedure is quite informal. Common sense, rather than complicated legal technicalities, governs the submission of documentary evidence and the giving of testimony by witnesses both through direct statement and through questioning. It is an honest search for the truth in the issue rather

than a battle of wits. Legal quibbling is ruled out; oratory would be ridiculous.

After all the evidence has been submitted and the arbitrator, who is free to ask questions, feels that he knows and understands all the relevant facts, the hearing ends. The arbitrator may make his award at once, or he may want to consider the matter for a day or two. Once made, however, the award is final and may be entered as a judgment of the court. There can be no reversal or setting aside of the award unless fraud or other misconduct can be shown. If a board of three arbitrators has been sitting, the award may be made by majority vote.

In case of a controversy between a dentist and a patient over the competency of the work done or the payment to be made, it is probable that a board of three arbitrators would be asked to sit; for the patient would probably be disinclined to leave decision to another dentist, and at the same time expert opinion as to the work performed would be essential to an intelligent decision. Under these circumstances, an arbitral board satisfactory to both disputants would probably be composed of an outstanding dental authority and two men from other professions or business.

The surgery case already referred to is illustrative of this point. A noted opthalmologist agreed to perform a cataract operation for $1,000. Just before the time set for the operation, the patient complained of trouble with the lashes on the lower lid, and a special operation, called, the Ziegler puncture, was performed. Then the patient, with the surgeon's permission, went to the country for the summer. In the fall, a reexamination revealed an infection, which necessitated removal of the tear glands. Shortly after this had been done, the cataract operation was performed satisfactorily and the surgeon then submitted a bill for $2,300, on the basis of $1,000 for removal of the cataract; $500 each for the two special operations which had been found to be necessary, and $300 for numerous office treatments. The patient contested these charges, and the matter went to arbitration before an internationally known opthalmologist, a publisher and a realtor. At the hearing, the surgeon testified that all three operations had been necessary and that it was therefore his duty to perform them. The cataract could have been removed without prior operations on the tear glands, but it would have meant the death of the aged patient. Question of payment had not entered into the decision to perform the two extra operations; in fact, 90 per cent of his operating was done free of charge in city hospitals. On questioning, the patient testified that the charges were not beyond his means.

The decision was that the doctor was entitled to his full claim of $2,300.

Under the improved arbitration laws which are now in force in New York, New Jersey, Massachusetts and Oregon, the proved benefits from this method of settling disputes can be obtained in either of two ways. Agreement to arbitrate a controversy may be jointly made after the dispute has arisen; and once entered into, both parties must proceed to arbitrate and to abide by the award. Or a contract may include a clause providing for the arbitration of any controversy which might possibly arise in the performance of the contract, and both sides must then arbitrate any such controversy.

The latter feature is becoming recognized as the outstanding contribution of arbitration to the reduction of litigation and the promotion of goodwill in business and contractual relations. At first thought, it may seem illegal to prepare for controversy when entering into a contractual agreement in good faith. But it takes no great business experience to learn that honest controversies do arise, and it is better to take advantage of a time of complete accord to arrange for the speedy and intelligent disposition of any possible misunderstanding than to wait until a dispute has arisen and has inspired some doubt and perhaps heat in the process of coming to a head. Present development of arbitration legislation is therefore making specific provision for the enforceability of such clauses in contracts, and business is more and more taking advantage of this wider scope as a form of insurance against litigation. For instance, a sanitarium in New York City has placed on its admission card the following clause: "It is agreed that all claims and disputes of every nature will be settled and determined by arbitration under the law of the State of New York before the Arbitration Society of America and under its rules."

The action of the delegates to the Louisville Session of the American Dental Association in endorsing the principle of arbitration and authorizing the judicial council to study its possible application by the dental profession makes the subject one of real and immediate concern to the individual members. The council's report and recommendations will be awaited with keen interest.

CORRECTING AND IMPROVING THE OCCLUSION OF FULL DENTURES

By W. T. SIMS, D.D.S., Hillsboro, Texas

WITHIN the last few years, it has been the observation of all general practitioners of dentistry that the number of full dentures constructed is on the increase. When dentures cannot be used by the patient satisfactorily, beyond a doubt the defect is far more often in faulty occlusion of the teeth than in the so-called "fit" of the plates. Too often, in the past, after the most careful attention to every detail of construction of full dentures, I found that, when the plates were placed in the patient's mouth, the teeth were too long on one side of the mouth and too short on the other side, and in some instances rebasing or excessive grinding of the teeth was required in order to obtain proper occlusion.

It is my purpose to give in detail a simple technic that will correct all errors of occlusion that may exist before the dentures are vulcanized.

TECHNIC

Step 1.—When teeth are set up, try them in the mouth and make all changes or corrections of the six anteriors. Remove the upper base plate from the mouth, and place a strip of

yellow wax about 3 mm. wide and 15 mm. long on each side of the palatal surface of the base plate just over the second molars. Soften the wax in a flame with a chip blower; place the

Application of strips to base plate.

base plate in the mouth and have the patient close. Heat the wax two or three times and have the patient repeat closing. The accompanying illustration shows where the two strips of wax should be placed in the base plate. At this stage, when both base plates are placed on the casts (models) and the articulator is closed, the posterior teeth will strike first and the anterior teeth will be found standing "open."

Step 2.—Place the lower base plate on the lower cast, and place the upper base plate in occlusion with the lower. Cut the upper cast loose from the upper cast plate, and put the upper cast into place with the upper base plate, and replaster to the cast plate. An examination of the upper base plate at this time will show that it stands too far away from the cast, and, if waxed and vulcanized at this stage would make the plate too thick.

Step 3.—Remove the wax from the upper base plate and reocclude the upper bicuspids and molars with the lowers.

Step 4.—Lute the upper and lower base plates to the casts. Smear the occlusal surfaces of the bicuspids and molars with glycerin and carborundum grinding powder, No. 220, and give the dentures a light grinding. They are then ready to be flasked.

I have used this technic for some time and I believe it would prove successful with any good articulator. Its use has proved more satisfactory than former haphazard methods of obtaining proper occlusion of teeth, and it has also improved the fit and adaptation of both upper and lower dentures.

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Editorial

LET US MAKE GOOD

The profession owes many things to the public which some of our members do not seem to realize. Our obligation does not cease when we fill a tooth or insert a denture; when we extract a root or clean a set of teeth, or when we perform any other kind of technical procedure. We are far from fulfilling our whole duty by merely administering professional or individual service. It has often been said, and with truth, that we should be educators, that it is our function to instruct the people on all matters connected with oral hygiene, and that we should strive to guide them along those lines which would ultimately lead to a prevention of dental disease. No truth is more fundamental than that the profession owes this to the public; and in fact much effort has been expended in this direction, and many men and women have labored hard to deliver this message.

Up to this point, we have tried to make good and to keep faith with the people; but there is another angle to the situation. Too frequently, dentists in practice have failed to carry out in

their offices the principles laid down to the public by our teachers. When told that early attention to the teeth is necessary, parents naturally take their children to the dentist, only, in many instances, to be told that it is useless to fill deciduous teeth because they are to be lost in a few years. They are consequently confused by the discrepancy between the advice given in the public prints or on the lecture platform, and the attitude of the dentist in his office. This does not tend toward respect for the profession on the part of the people.

Not only this, but there is frequently such a decided lack of uniformity in the advice given by different dentists on certain fundamental matters connected with the teeth that the patient is completely at sea as to what is for his welfare. Take the one instance of pulpless teeth. In recent years, there has been such a variety of opinion expressed about these teeth that an individual having pulpless teeth has been in a quandry to know what is best to be done with them.

In denture work, the same confusion prevails: one man advises that when there are a few good natural teeth left, these should be preserved and a partial denture or bridge be inserted; while another declares that better service can be rendered by removing all the natural teeth and resorting to full dentures.

This conflicting advice is met in almost every department of our work, and it cannot all be excused on the ground that every man is entitled to his opinion, and that we cannot look for unanimity of ideas on the part of the entire profession. Every man is not entitled to his opinion in so vital a matter as the physical and mental well-being of the patient, unless that opinion is founded upon deep scientific study and practical experience. Erroneous advice is frequently given through expediency, and on account of a personal predilection which is not founded on well-considered fact.

We should think more seriously on the advice we give, and we should systematically confer with each other, not only through our literature and at our conventions, but also individually and frequently, in the attempt to arrive at a more uniform opinion on

those problems which so intimately concern the people and on which they come to us for guidance.

In other words, we must learn to agree better among ourselves before we can hope to impress the people and render them the service to which they are entitled. It is this particular obligation which we have so generally overlooked in the past, and to whose fulfilment we should now devote ourselves as a duty paramount to all others. Let us keep faith with the people and make good.

DENTAL HEALTH WEEKS

Setting aside a week to concentrate on one idea and proclaim its virtues to the world has grown to be quite an institution in our modern civilization. Prominent among the various "weeks," and most laudable in purpose, is health week. In many communities, health week has assumed the impetus of a real community urge, and in its annual recurrence it gains momentum with each succeeding year. This is as it should be, because all advancement in modes of living must have as its foundation the mainspring of education. People must be educated in the best manner of living before they can hope to live well. The knowledge which the professions have achieved should be carried on down to the people in such form that it can be used to advantage; and this is the object of health week.

One of the most important of all health movements is the inauguration of a dental health week, whereby the importance of the teeth and their significance in health and disease is made manifest to the masses, as well as the best means of preventing dental disease demonstrated in such a way that the lesson can be carried into the home and put in practice. To create mass sentiment, there must be a mass movement, and dental health week is calculated to bring this about.

Several states, notably Texas, Mississippi and Pennsylvania, have inaugurated state-wide dental health weeks. Pennsylvania has planned a "week" on a more comprehensive scale than

ever, to be held May 1-7, 1926. The idea should grow throughout all of the states till the message of dental health shall be carried to every hamlet and home in the land. And then, what is of chief importance, the dentist in his office should cooperate with the men and women who teach and preach the gospel of oral health, by carrying out in practice what is taught in lectures and literature. Mayhap, dental health week will prove of as great benefit to the members of the profession as to the people themselves, in bringing the dentist to a sense of his responsibility, and keying him up to better service in order that he keep faith with the people who have been impressed with the lessons taught by this mass effort. By all means, let us have dental health weeks, and let us profit by them in an improved service to the people.

JUST TWO PARAGRAPHS

We have been permitted to see two paragraphs from the will of the late Dr. E. S. Gaylord, whose passing we noted in our February issue. In that notice, we referred to his interest in the relief fund of the American Dental Association, and to his general tendency toward philanthropy. This is emphasized most eloquently by the two paragraphs referred to, which read as follows:

> To the National Relief Fund I give the sum of five hundred dollars.
>
> I give the rest and residue of my estate to the Maryland College of Dental Surgery to be held as a trust fund, the income to be used to aid poor worthy dental students.

Just those two simple statements, but what a wealth of significance they contain. If any other dentist has left a similar bequest, we have not heard of it. Men may have left funds for the encouragement of research and other professional endeavor, but this is the first instance coming to our knowledge of a dentist setting aside a portion of his estate for the direct relief of his needy fellow practitioners, and for the purpose of assisting worthy and struggling dental students. It is unique, timely and most appropriate. And it is wholly typical of the man who did it, the man who always had a kind and encouraging word for every member

of the profession, young or old. Now it is seen that his words were not mere empty phrases, but the index of what he really felt and thought. In his death, he has translated into concrete and tangible fulfilment the kindly impulses which pervaded his whole being, and has left a most worthy example for other men to follow. In the future, when a dentist is so fortunate as to have more than enough to supply the needs of his immediate family, let him take a text from these two paragraphs in Dr. Gaylord's will, and make such provision as will endear his memory to the profession for all future time.

THE SEASONS—SPRING

This is the season of all seasons—when the rigorous hand of winter, which has held us bound indoors so long, relaxes, and lets us out into the open. The first smell of spring—who can describe it? Even the animals feel the thrill. The birds come back—the blessed birds, bringing their songs, and building their nests. All Nature shakes itself and begins to wake up. The snow sinks quietly into the earth, or rushes off in torrents toward the sea. The rivers are swollen and boisterous and happy, sweeping turbulently along in wild revelry and cutting into banks and overflowing the low lands. Sometimes, they take irreverent liberties with human kind, and exact a treacherous toll. But most of the floods are due to the meddling of man, and not to the mistakes of Nature. We wantonly cut down the forests, and devastate the wooded slopes, and then we wonder why we have floods. After we have done the damage, we wake up, and try to remedy the harm by a belated conservation. It is fortunate that we waken at all.

The spring is the blossoming time of the year, the bursting of everything into new life, and energy and hope and aspiration. The lethargy of late winter is shaken—the hiberation of all Nature is over. We take a long breath and expand our lungs, drinking in the balm of the soft warm air. We uncover our heads, and let the zephyrs blow upon our brows. Everything

yields to the wizardry of spring. The frost king lets go his grip on the earth. The sun beats him back into the farthest recesses of the north, and smiles as he retreats. The anxious crocuses and tulips force their way timidly through the surface of the soil, and gladden our hearts with the brilliancy of their hues.

Youth is renewed, and the weary pilgrim, worn with the rigors of the winter, takes heart, and welcomes the vernal awakening. It is the great resurrection—the coming into life again. All things yield to the spell of spring. The animals that roll themselves up into a ball and sleep through the winter begin to stir and come out in the open. They sniff the moist air and pronounce it good. The grass peeps through every tiny crack and crevice of the earth, and clothes the surface with the softest green, covering over the barrenness made by the sterile winter.

And best are the buds and blossoms—the miracle of it all. What a glorious transformation from the bare cold gray limbs and twigs to the bursting luscious green, softening the outlines and rounding out the trees into forms of rarest beauty and harmony. And after the green of the leaves, and peeping brightly through them, come the pink and white and delicate hues of the blossoms, glorifying the landscape down through the orchard and along the river banks, where the wild plum and cherry trees cling to the fringe of civilization and speak of the glad free days of the pioneer.

Spring is the love season of the year, when the birds mate and sing their songs of domestic joy. The first robin is an event—his cheering chirp a herald of the happy days to come. The frogs are booming in the marsh; the hens are cackling in the mow; the wabbly lambs are bleating by the bars, and the ducks are waddling toward the pond.

All Nature stirs to the springtime charm. The banking is torn from around the house to let in the fresh free air, the doors are left open, the storm windows are removed, the refuse is raked in the yard and consigned to the purifying flames. The stolid teams go out with plow and harrow to agitate the moist surface of the earth. The seeds are sown and covered up. In straight

rows, the roots are planted, waiting for the genial heat of the sun. The days are growing longer, and the twilight lingers in loving memory of the sunlit hours. We sit on the porch in the evening and listen to the strident tones of the katydid. We waken in the morning to the music of rustling leaves by the open window, fanned by the siren winds of the south.

As we look out across the fields, there is promise of plenty in the bursting, vigorous, ravishing growth. Nature is alive and alert, busy with the building of form and color, busy with the marvelous alchemy of production.

All hail to spring, the balmest and most blessed season of them all!

WANTED

One thing that is sadly wanted in this profession of ours is uniformity on the part of radiographers in the mounting of roentgen-ray films. As it is now, one man mounts them so that the examiner looks at them from the labial and buccal aspect, while another mounts them so that they are viewed from the lingual. This is confusing. When a practitioner receives films for examination, he first has to study them to see which is the right side and which the left. This should not be necessary. Our radiographers should get together on this problem, and come to some agreement so that there shall be uniformity of mounting. This would save much time and confusion, and in certain instances it would avoid uncertainty.

But what is worse than mounting by different methods is the practice of some men in not mounting at all. It is a very cheerful process for the general practitioner to fish a lot of unmounted films from a small envelop, and then laboriously sort them out and try to locate the teeth on the different films. This is rendered all the more attractive when the practitioner is pressed for time, and is examining the pictures as an emergency to accommodate a patient. Our radiographers should have some consideration for the men who are called on to examine their films.

DEPARTMENT OF DENTAL HEALTH EDUCATION

THE LEGAL AND PROFESSIONAL STATUS OF THE DENTAL HYGIENIST*

By GUY S. MILLBERRY, D.D.S., San Francisco, California

TO review the legal status of a group of individuals whose duties and privileges are defined by civil law is merely a question of statistical analysis and comparison. It lacks the exciting qualities of suspicion, horror, revenge and fear, which are to be found under criminal law; therefore, my discussion will be dry and uninteresting.

Twenty-six states, including one of our island possessions, Hawaii, have enacted laws regulating practice for the dental hygienist. In the majority of these, she is designated by that title, though oral hygienist, dental nurse or dental assistant is used in some states.

In general, the requirements are similar, so it may be best to state them and then mention the exceptions. By comparison, we can best judge of the legal status, even though comparisons are odious.

The minimum age limit for licensure ranges from 18 to 21 years, and the sex limitation is in effect in about half of the states. Ten states limit licensure to women; while fourteen admit both sexes, and two make no reference to sex. The fact that more states provide that both sexes may qualify for a license than do not is probably explained by legislative fear that a sex specification would be considered class legislation and hence would be illegal. Some laws state that "any person" may take the examinations and "she" must do certain things in the same paragraph, which would imply ambiguity, at least, in interpretation.

The preliminary educational requirement varies, and eight states do not specify in the law, except, perhaps, indirectly, as is done in the California law, which designates the University of California course of study as a standard. That course of study demands the regular admission requirement of a four year accredited high school course, with recommendations. Three states demand one year of high school work; four states demand two years of high school work, and eleven states demand four

*The papers of Drs. Millberry and Fones were a part of a symposium, the remaining papers of which will be published in the next issue, with the discussion.

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Sixty-Seventh Annual Session of the American Dental Association, Louisville, Ky., Sept. 23, 1925.

years of high school work. The subject matter of the licensing examinations varies and is influenced somewhat by the training schools in the several states. An effort to standardize this is being made through the American Association of Schools for Dental Hygienists, but it will not be reflected in the laws for a long time.

With the exception of five states, every hygienist must have had at least one year of instruction in a training school, or be a graduate of a reputable school. Both schools must have been evaluated by the board of dental examiners. Maine will admit candidates to the examinations after six months of training under a licensed dentist; while Massachusetts, Minnesota, New Hampshire and Vermont will admit a graduate nurse who has had three months of dental training in a school for hygienists.

It is quite evident that the comprehension which the dental profession has of the duties of the dental hygienist and her public health service is not at all uniform in America, as far as her training is concerned. In defining the duties by law, there has been a greater uniformity than in any other licensing requirement. All of the states specify that a dental hygienist may remove accretions, deposits or stains from the teeth. The majority of the states, with a truly democratic spirit, specify the removal of "lime deposits," while others, with philologic exactitude, insist on the removal of "calcareous" or "calcic" deposits. One state merely says that the "tartar" may be removed.

The statute of limitations seems to have been a source of worry in drafting the several laws for much apprehension is apparent in defining the line of demarcation between what constitutes dental hygiene service and dental service; for, in most states, the dental hygienist may remove lime deposits from the exposed surfaces of the teeth only. In Iowa, Connecticut, Wyoming and South Carolina, she may operate just beneath the free margin of the gum, and, in the latter state, may polish fillings and roughened enamel to prevent decay. In Tennessee and Mississippi, greater liberality prevails in that she may remove these deposits, accretions and stains from the teeth and from the tissues of the mouth.

Louisiana, Michigan, Washington, and Wisconsin believe in liquid antiseptics, for they permit the hygienists to apply mouth washes. I presume that mouth washes are also sold at the drug stores in these states to the public for personal use.

West Virginia believes in postoperative and prophylactic treatment of the teeth and gums and has so specified in the permitted duties of the dental hygienist.

Minnesota has incorporated a section in the law that is not found in any other law. I would question the advisability of it very seriously. Dental hygienists are licensed "to administer gas and other anesthetics." The realms of anesthesia and the realms of death are really coincident, and the hazards at all times are great. To entrust this duty by law to persons whose training normally is limited and quite foreign to anesthesiology seems questionable.

Most of the laws provide at least the penalty of revocation of license for cause. Twenty states so specifying distinctly. Fourteen states favor reciprocal relations between states; while eleven oppose it, and one makes no reference to it.

The license examination fee varies and is relatively unimportant as it is

paid but once. The annual registration fee ranges from 50 cents to $10, with a decided variation as to policy. Thirteen states do not specify the time of payment; five require that the registration fee be paid but once, while eight require that it be paid annually. I believe that the only reasonable check on the number, location and status of the licensed hygienists is afforded by the annual registration fee plan and that it should be universally adopted.

I do not know whether it is appropriate to make recommendations before this section or not, but, if I may be permitted to do so, I would suggest that the section go on record by passing resolutions asking the American Dental Hygienists Association, now assembled here, to study the question of legislation pertaining to them and to approach the dental legislative committees of the various states in which laws are not to be found on the statutes in order that such laws may be enacted for the benefit of the children. This may be done either directly or through the American Dental Association. I would suggest also that this section proffer its services in helping to frame and introduce this legislation, if such service is desired.

Professional status in any calling is difficult to define. One is tempted to determine, first, whether the calling is a profession, a trade or an occupation, especially since the professions have been extended from the three so-called learned professions, law, medicine and theology, to many activities, including dancing, tonsorial art and office building management. While anyone may announce or affirm his skill publicly and thus become a "professor" in the strictest sense of the term, we ordinarily look on a profession as an occupation that properly involves a liberal education or its equivalent, and mental, rather than manual, labor. Thus art, music, editorial work, or authorship, and engineering have been readily accepted as professions.

Does the dental hygienist occupy a professional position in society? I believe that she does, and that this position should be enlarged and strengthened by the profession which created it. Just as dentistry has come to be recognized as a profession through its relations with medicine and not with technology, so has this new profession been recognized as a descendant of one of the "three learned professions," medicine or the healing art. Further, any calling which involves special mental and other attainments or special discipline may appropriately be classed as a profession.

But why this discussion? There are two reasons: one is that the dental profession can make or mar the professional status of the hygienists and the other is that the hygienists themselves should be encouraged in every possible way to sustain and improve their professional standards.

The influences exerted by the dental profession are transmitted through the training schools, professional associations and public or private employment. The training school faculty consists of dentists chiefly, with other professional teachers, and occasionally a graduate dental hygienist, added to the group. The preponderance of influence lies with the dental profession because of numbers and of the subjects taught. They can elevate or lower the standards of the dental hygienist's service, inculcate high ideals and give to students the inspiration, or the reverse, that will be reflected in their lives as long as they practice. This responsibility falls on groups who are capable of fulfilling

their duty satisfactorily, if they have the vision.

Professional associations are less vital to dental hygienists, individually or collectively, yet, through leadership, such organizations can exert a desirable influence. The American Dental Association, one of the foremost in recognizing this fact, adopted resolutions at the annual session, in 1922, welcoming the organization of the American Dental Hygienists Association and establishing a cordial professional relationship that has resulted in as close a unanimity of professional purposes as is possible between two organizations of such wide variations of age and experience, yet having kindred interests.

The American Dental Association can do more to strengthen this relationship and sustain the professional status of the dental hygienist than any other outside agency, by making it possible for every member of the American Dental Hygienists Association to have a subscription to THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION and a department of their own activities. The Section on Mouth Hygiene and Preventive Dentistry might appropriately go on record by endorsing this proposal and adopting resolutions providing ways and means for its accomplishment, this matter to be transmitted to the trustees.

Public or private employment as a means of sustaining the professional status of the dental hygienist is a matter of individual opinion. The county health officer, superintendent of schools, director of the health center or county dentist who occupies the position of employer or supervisor of the dental hygienist for his district or community will judge of her standing by her training, experience, poise, personality, and even her appearance, and he will evaluate these by comparison with the attributes of other district or community officials with whom he associates or who are under his supervision.

Here, again, lies the opportunity for the dental profession to exert its influence by educating such officials to a degree of recognition appropriate for a new profession that will add much to the health and happiness of our children. The dentist who fails to take advantage of this opportunity to perform a civic duty is not a progressive member of this association or a good citizen.

The private employer finds himself in one of two classes: first, those who recognize the value of conscientious, hygienic service for their clients, especially the children, and who encourage professional growth by placing responsibility on the hygienist and teaching her those principles in office conduct which lead to the highest recognition of professional service; or, second, those who desire to profit at her expense by relegating to her the unpleasant task of rendering a hygienic or prophylactic service for the affluent, indolent patients who can afford to pay for it. Such service is of the menial type and offers no opportunity for professional advancement. It is merely a "job."

The organized hygienists themselves are in a position to create a professional atmosphere that will do more to elevate their professional status than any other group can. They have wider contacts as a rule than dentists have; at least they have a better opportunity to take advantage of their contacts, and their work encroaches on the educational and

public health nursing groups so closely as to bring them into relationship with these people frequently.

When the dental hygienist is given a good ethical training in her alma mater, and has in addition to that the higher moral qualities with which women are endowed more than men, and an opportunity for development which district, state, and national meetings, such as this, offer, we may reasonably expect that her legal and professional status will equal, if not surpass, that of the dentist in America.

THE FUTURE OF THE DENTAL HYGIENIST IN PUBLIC HEALTH WORK*

By ALFRED C. FONES, D.D.S., Bridgeport, Connecticut

THE title of this paper does not signify a desire on my part to stand before you as a prophet: it was assigned to me by the chairman of this section. In analyzing the topic, it became necessary to decide what was meant by public health work. It would seem that, by the nature of their special service, dental hygienists are contributing to public health wherever they are employed. Any effort which results in an improvement in the physical condition of individuals contributes to the public health, so that hygienists, whether they are engaged in private practice or in public or private institutions, may well feel that their services can have an important influence. However, the generally accepted point of view of public health work is that wherein certain phases of health work are carried on by combined community effort to reach the people *en masse*, with the public paying the bill through taxes. The principal agencies operating in this field are (1) health departments of the city, county and state; (2) hospitals and infirmaries that are not privately endowed, and (3) the public schools.

I have considered the future of the hygienist only in connection with the public schools for the reason that health departments are organized primarily to control contagion and are enlarged with the growth of cities to control sanitation of milk, water and food supplies, the disposal of waste, etc. Ordinarily, these departments are seldom in direct contact with more than 10 per cent of the people. The services of hospitals and sanitariums are focused on curing the sick, who are discharged as rapidly as possible, so that the contact with the public is seldom more than 1 per cent at any one time. Thus, it seems that the public schools, which are established by society to safeguard its future, and which reach, as they do, all the children of all the people, offer the largest contact with the public. It is safe to say that 90 per cent of all constructive health work for the future will be done through this agency.

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Sixty-Seventh Annual Session of the American Dental Association, Louisville, Ky., Sept. 23, 1925.

The future of the dental hygienist in public school work can be determined only by the service the educational authorities, in cooperation with the dental profession, desire from an auxiliary worker in this particular field. If we accept the hygienist as one whose sole field of endeavor is to clean and polish teeth, and instruct in the use of the toothbrush and other cleansing agents to secure and maintain clean mouths, the future is not hard to predict. It must be simply a yearly repetition of that service. The prophylactic treatments and instruction in the care of the mouth will always be an exceedingly important work, but we must not lose sight of the fact that these efforts can deal only with the conditions of mouths as they exist today, and cannot, of themselves, solve the great problem of securing dense, sound tooth structure for the coming generation.

Every thinking man in dentistry realizes that the mouth is a small but important part of the human organism, and that, in their formative period, the teeth and their supporting structures receive the same nourishment and growth stimuli that govern all other tissues and structures of the developing organism. The mouth cannot be considered independently, as though it were subject to its own laws of health and disease; for, although much can be done in an operative way to prevent pathologic conditions of the teeth and gums, owing to their accessibility, the tone of these tissues and their salivary environment is dependent on the same blood stream which nourishes every cell in the body. Thus, it seems that the dental health of a race can be no better than the general health, and mouth hygiene is but a small part of general hygiene.

From this conception of the interdependence of mouth health and general health, it has seemed to evolve naturally that the field of the hygienist must be two-fold: First, there is the service for the improvement of mouth conditions as they exist today—the prophylactic treatment and instruction in the hygiene of the mouth to aid in the prevention of dental caries and gingivitis, as far as it is possible to do so by cleanliness and artificial gum stimulation. Secondly, there is the educational service concerning those laws of general hygiene which promote the development and growth of a normal, healthy body. It is this very important work that must eventually influence the coming generations; for only through education can we hope to secure better teeth and a higher degree of immunity to dental diseases. The problem in dentistry is to devise not only the means of preventing, as far as possible, the progress of dental disease which is already present, but also, which is of far more importance, a means to carry out all those measures which tend to secure protection against dental disease to the coming generations. In the light of recent research, it is reasonable to assume that if the dental profession makes an effort to secure sound teeth and healthy mouths for the coming generation, it can only be done through the application of known health factors during the prenatal, infant and early childhood periods. By health factors, we mean proper food, sunlight and fresh air, sanitation, exercise, rest, sleep, mental poise, etc. The effort of dentistry to insure dental health through the application of these principles will result in strong and healthy bodies as well. Conversely, the physician who instructs a prospective mother, and later the child,

in the laws of hygiene, will consciously or unconsciously produce a set of sound teeth. Thus it is that the body is built as a whole, and the teeth are an index to the structure of all other tissues.

With this thought in mind, it would seem that dentistry will be dependent on the dental hygienist to spread education in general hygiene as an important part of her work. If the dental profession is to discharge her obligation to future generations, there must be a definite effort within the profession to place large numbers of dental hygienists in public schools, where the greatest good can accrue to the largest number through public education. It has been suggested that the members of the dental profession are stepping beyond their province when they begin to advise regarding food values and other health measures, and that such information should be dispensed only through the medical profession. But established truths and scientific facts are for the benefit of the human race, and can be effective only when they become common knowledge. The cooperation of all agencies dealing with public health is needed to spread this education. If it could be said to be the prerogative of any one profession to disseminate knowledge of the laws of health, the profession would be that of teaching. The superintendents of the public schools can do more than any other group to advance public health through the channels of health education. It lies within their power to convince boards of education of the importance of physical supervision of children, and the need for the establishment of health education departments for the schools. It is in such a cooperative system that dentistry can do its best work for true prevention, and the means to that end will be found in the work of the dental hygienists. Therefore, it may be stated that the future of the dental hygienist in public health work can be determined only by the extent of the field of general hygiene she is trained to cover and will be allowed to teach in the public schools.

A special point must be made regarding the fact that boards of education are supreme in the management of the public schools, and that only with the permission and cooperation of superintendents of schools can dental hygienists gain access to the classrooms, especially in an educational capacity. Because of this perfectly just situation, I have, for several years, predicted that the hygienist who is employed in public schools will eventually receive a special training to fit her for the larger educational service that this field presents. I believe that, in the not distant future, public school hygienists will be prepared at the expense of the state by courses in connection with the state normal training schools for teachers; not because the present well established courses are inadequate in any respect, but because the hygienist will be more acceptable to the school administrators and will be permitted to function in a broader educational capacity if trained as a specialized teacher under the supervision of the state department of education.

In Connecticut, this plan to utilize a specially trained hygienist to further a general health program has met with the favorable endorsement of the state educational authorities, who have applied to the legislature for funds to create a department of public school hygienists in connection with one of the state normal schools. As yet, the appropriation has not been secured; for, although the state provides hundreds of

thousands of dollars for the mental training of its future citizens, the realization that the physical development must also be provided for is only just dawning. This brings us to the argument, often presented when local appropriations are asked for, for public school hygienists, that this is too much money to spend on teeth when they are only one phase of the school child's health. This point arises from a lack of understanding of the far-reaching effect of the hygienist's service, one which I have tried to analyze in this paper because many dentists still believe that she is merely a "scrubber of teeth." A study of the curriculum of any of the recognized schools for dental hygienists should be enough to convince the most skeptical that these courses are turning out health workers.

CONCLUSION

The hygienist was developed as a specialist to assist in securing clean mouths, sound teeth and healthy gums for the people. Experience shows that she can do this more effectively by working in harmony with the general health laws. The universal prevalence of defective dental tissues demands her services wherever the greatest good can be accomplished for the greatest numbers, and it therefore seems inevitable that she must operate chiefly through the public schools.

In the majority of states, all of the health work in the schools is placed by law in the hands of boards of education, so that it seems logical to say that the state educational authorities will eventually assume the responsibility for training all who are employed in the public schools.

THE TEACHING OF ORAL HYGIENE AND ITS RESULTS IN BRIDGEPORT*

By ALFRED C. FONES, D.D.S., Bridgeport, Connecticut

THE plan to demonstrate what might be accomplished by an educational and preventive type of dental service as contrasted with the usual relief and repair clinic, for large groups of school children, has been recited so many times that it must be well known. We have been fortunate enough to be allowed to complete a ten-year demonstration along the following lines: Prophylactic treatments and examination of the mouths of all children was carried out in grades one to five; with toothbrush drills for all grades, and class room talks in all grades.

All this has been accomplished by a corps of dental hygienists, who actually worked for about 20,000 children yearly, and came in contact with a far larger number in an educational way. The additional features of the service were provided by the school dentists, and included the filling of the fissure cavities to preserve the first permanent molars when these teeth first erupted.

*Read at the Third International Mouth Hygiene Luncheon of the American Dental Association, Louisville, Ky., Sept. 23, 1925.

This was confined to the first and second grades. As part of the attempt to secure wholesome mouth conditions, the dentists extracted abscessed deciduous teeth for children of any grade. No general operative work was attempted, this being referred to the central dental clinic, outside the school buildings. Dental hygienists carried out the greater part of the service, which was originally directed by the board of health, but later transferred to the board of education. There is no doubt that this type of service can function best under the direction of the board of education, for many reasons, the most important being the elimination of the possibility of friction with the school authorities and all school employes, making possible the fulfilment of a comprehensive educational program. Under the board of education, the utmost in cooperation was received, and increasing opportunities for broadening the scope of our program were offered, until the dental hygiene corps was finally employed under contract with the board of education as special teachers who were responsible for definite class room instruction. These lectures covered most phases of general hygiene. Especial emphasis was placed on foods and the importance of a correct dietary to sound teeth. The dietetic instruction was coordinated with that of the domestic science courses, so that the children had a unified point of view in this respect.

This briefly reviews the means employed to better the mouth and general health conditions of thousands of children. The results, which have previously been published in much detail, can be mentioned but briefly.

STATISTICAL DATA

The statistics are compiled from the records of the mouths of the fifth grade control class examined at the beginning of the demonstration, and compared with those of the fifth grade of 1924.

The number of cavities in the permanent teeth of the control class was 5.5. In the class of 1924, the number of cavities was 2.5—a reduction of more than 50 per cent of dental caries in the permanent teeth.

In the control class, thirty-five children out of every hundred had lost one or more of these first permanent molars. In 1924, only eighteen out of every hundred had lost first permanent molars.

At the beginning of the demonstration, only twelve children in every hundred had the first permanent molars filled. After ten years of education regarding the value of these important teeth, and their great susceptibility to decay, sixty children out of a hundred were found to have had the first permanent molars filled.

Whereas it was almost impossible to find a child with sound permanent teeth during the original mouth examinations, there were 31 per cent of children with sound teeth at the completion of the ten-year period.

Before the inauguration of dental hygiene service, 62 per cent of the children examined had unclean mouths, and only 15 per cent were found to be making a daily effort to clean their mouths. In 1924, clean mouths predominated through the grades, which numbered 2,500 children.

It was rare to find a child without a toothbrush, and practically all had acquired skill in mouth brushing. Dark red and congested gums, which were

conspicuous in 1914, were the exception, the large majority of the children possessing healthy gum tissue.

During the ten years of dental hygiene in the schools, the effects of the mouth sanitation campaign were felt in the homes, and its lessons applied to the children of preschool age. This is shown by the fact that the number of children entering first grade with clean mouths has increased 50 per cent, and the number of children who did not use toothbrushes during the preschool period has decreased from 60 to 9 per cent.

There is no doubt that many of the most significant results from a demonstration of this kind cannot be shown by figures. Our present realization of the interdependence of mouth health and general health makes it difficult to estimate the far-reaching effects of early education in general hygiene and dietetics. It is of interest to note the point of view of the superintendent of schools in Bridgeport, who said in his annual report to the board of education, "I am convinced that, no matter what is the final form of health service organized into the public school curriculum of America, as an ingredient in that health service there will be accepted everywhere the idea of prophylactic dental service. The repair dental clinic, while better than none, cannot satisfy the demand of the education department. It is corrective only, and the contribution through education to any generation for the next generation would be positively static should the schools submit to the demands of any group that control be its fundamental. We are passing through the stage of prevention, but education will finally press this to the stage of positive protection, and in that stage the enlarged practice of prophylaxis in relation to mouth conditions must of necessity form an element."

THE PLACE OF ORAL HYGIENE IN THE HEALTH PROGRAM OF LOS ANGELES COUNTY

By EMMA PITTENGER DURBIN*, Los Angeles, California

IT is a comparatively easy thing, if one has had organization experience, to start a new work, even without funds, if the chief of the department gives one permission to go "just as far as you have sense enough to take you," and means it when he says it.

That is the way the oral hygiene division of the Los Angeles County Health Department came into existence, in 1921.

*Director of Oral Hygiene, Los Angeles County Health Department.

The state tuberculosis association permitted the use of 50 per cent of the funds raised by the county association toward establishing this work the first year, and has backed it in many ways ever since. The Junior Red Cross donated a portable dental equipment, costing about $400. A school was found that was willing to allow the experiment of having a dentist work in the building.

The greatest difficulty was experienced in finding a suitable dentist.

Those who were available knew nothing of children and their needs. One was finally secured, and the work started. As in all new programs, there was considerable waste motion. At first, the equipment was so bulky that it was necessary to call a truck to move

Fig. 1.—Billy Lord, from the movies, the mascot of the Los Angeles Police Department, and a deputy health officer, who assists in the dental health campaigns in Los Angeles.

it; but, little by little, it was found that by changing some things and eliminating others, it could be easily packed in fifteen minutes and transported in a Ford coupe. When things were thus condensed, it was a great help.

During the first six months, the school boards were not asked to help finance the clinics, so naturally the funds became low. It was a great night indeed when the director and chief nurse of the county health department drove 30 miles into the country to a board meeting and, with the help of the principal, who was much interested, succeeded in convincing that board that they would be getting their money's worth if they would make a contract with the dentist for four days a month at $6.00 a day toward running expenses.

The greatest source of anxiety to the trustees at that meeting was the question as to whether they would be held to the contract if the dentist finished the work for all the children before the end of the school year. (There were about 700 enrolled.) Finally, the contract was signed. This was really a beginning.

From the very first, the children were charged for the work; so, in this particular, building was started on a firm foundation. Both the children and the parents have appreciated the service more because they did not have it given to them. The following schedule of fees has been in effect practically since the start:

Examination	Free
Prophylaxis	50c
Extractions	25c to 50c
Cement fillings	25c
Copper amalgam (always used for deciduous teeth)	50c
Silver amalgam	75c to $1.00
Silicates	75c to $1.25
Treatments	25c

Any child who is referred to the dentist by the social workers, nurses or teachers as being unable to pay is promptly cared for and his card marked N.C. (no charge).

At the end of the first year, the director was placed on the civil service list and her salary paid by the board of supervisors.

This detail about the early days is given because, in inquiries frequently received from those interested in establishing a like program, how the work first started has been a point of interest.

Many times, the members of the division smile yet at the courage displayed in placing an exhibit in the great tent at the National Dental Association Session

Fig. 2.—Billy Lord, from the movies, who assists in the dental health campaigns in Los Angeles.

in 1922, in Los Angeles. More than that, an original little oral hygiene play was given by a group of Mexican children in the same place. However, as these humble efforts were in close proximity to the wonderful display of the Forsythe work, which was in charge of Drs. Percy R. Howe and Harold DeWitt Cross of that institution, the director had a chance to learn much, and the help thus obtained has been passed on to the dentists and hygienists who have come into the work since that time, and it has largely determined the things which have been taught to the mothers and children in the direct relation of diet to tooth structure and development.

Now, in a little more than four years, there are about seventy schools and four health centers where dental clinics are carried on. The school boards are all paying $10.00 a day, or more, toward the work, and there is a long waiting list of schools that wish to have this program.

The dentists now receive their salaries from three sources. Four of them are paid entirely by the county board of supervisors, as are also the four hygienists. Five receive their salaries entirely from school boards, and one from the two boards; giving a force of ten full-time dentists, four dental hygienists and a director.

All of the dentists are young and most enthusiastic about their work. It would be hard to find a like group in any other one organization. Half of them are women. There is a division dinner every month, and no one would willingly miss it. Methods are freely discussed and reports given of anything especially interesting that has occurred in any district. Any of the members are free to bring guests, if they wish. Sometimes, when a local dentist who refuses to do children's work or who slights such work is found, he is invited to one of these dinners. He is asked to enter the discussion also and, without his knowing just why he was invited, he has almost always gone away with the idea that the care of the deciduous teeth is one of the most important things in dentistry.

The regular corrective work in the schools begins in the kindergarten or first grade, and is carried through the

fourth grade. All children are eligible to this service, but they are urged to go to the family dentist, if they have one.

The hygienists spend two days a week in educational work and three in doing prophylactic work. Many more hygienists could be used, if it were possible to secure them. Only a few from other states are eligible to take the California state board examination as the requirements are now at least a two years' course in dental hygiene; hence, the shortage here is very acute.

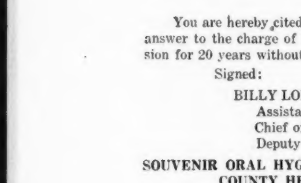
Fig. 3.—Muriel McCormac, little movie actress, dressed as "Sixth Year Molar." Muriel assists in the dental health campaigns in Los Angeles.

Work has just been started which seems to be an innovation. Perhaps someone has done it before, but, if so, none seem to have published the fact. A dental clinic has been fitted up in one of the health centers for the 2-to-5-year-old children, exclusively. These toddlers are to be examined only if the mothers will promise to return them for reexamination and supervision every three months. Accurate statistics are being kept as to age, sex, race, general condition physically, any past communicable diseases, diet since birth, amount of work necessary at first visit and each subsequent visit, the condition and diet of the mother during the prenatal period, and any other data which are deemed essential to a complete picture of the condition of each child. It is the intention to carry these children through the entire preschool period, having them enter school with mouths in healthy condition. Some interesting and helpful data will be obtained by the time the present 2-year-olds have to meet the strain of school life. All the workers are deeply interested in the possibilities of this new work and will watch developments eagerly. When it is necessary to put twenty-seven fillings in the mouth of a 3-year-old child, as one of the dentists did recently, it can readily be seen that work in the schools alone can hardly be said to be sufficient.

The school educational program consists of monthly inspection and grading on report cards, toothbrush drills, and the presentation of clean teeth buttons, with a second button which has a little policeman on it, given only when every defect is corrected. Class auto races are carried out. Red and blue card board is used for the cars, which are placed on the blackboard in the corner of the room. Classes are divided evenly

as to defects, and the car moves up a length for each child whose teeth have been put in good condition. If, at the end of the school year, the reds have traveled farthest, the blues must give them a party. Instructions in proper diet and other health habits are given.

The children carve teeth out of soap, so that, by the time they have arrived in the fifth grade, they know the shape of each tooth, its name and when it is to be shed if it is a deciduous one, with special emphasis, of course, on the importance of the first permanent molar.


You are hereby cited to appear in court June 24, 1924, to answer to the charge of having parked in the Dental Profession for 20 years without ever having taken care of children.

Signed:

BILLY LORD, Officer No. 666, Division No. 6.
Assistant to Chief Vollmer.
Chief of Los Angeles "Junior Times."
Deputy County Health Officer, L. A. County.

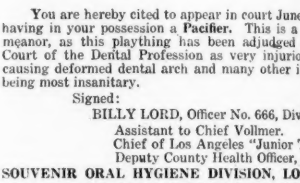
SOUVENIR ORAL HYGIENE DIVISION, LOS ANGELES COUNTY HEALTH DEPARTMENT

(over)

Fig. 4.—"Citation" issued by the Oral Hygiene Division of the Los Angeles County Health Department. The reverse side of the cards bears a picture of Billy Lord, little movie actor, attired as a policeman.

In many of the larger programs, little movie children are used. Sometimes there are as many as sixteen assisting at a time. Two of them, the little policeman, Billy Lord, who is really the mascot of the Los Angeles Police Department and a deputy health officer of Los Angeles County, and who goes around with a big brush to "brush away the dirt and 'De Kay Brownies' from the teeth of the children," and Baby Muriel McCormac, the little "Six-Year Molar" who dances a happy, happy dance because, while she "used to die in about a year, she can now live to be most a hundred," have been of the greatest assistance in teaching large groups of people some of the most important truths of oral hygiene. These children were secured through the active cooperation of the Los Angeles *Junior Times*.

An annual essay and poster contest is held which is not only teaching the children but also the teachers how important the teeth are. Here again the *Junior Times* has helped greatly, printing in colors on the front page, in June, a group of the best posters, and the names of those receiving prizes and honorable mention; and, on the inside pages, the winning essay. This to be an annual


You are hereby cited to appear in court June 24, 1924, for having in your possession a **Pacifier.** This is a grave misdemeanor, as this plaything has been adjudged by the High Court of the Dental Profession as very injurious to babies, causing deformed dental arch and many other ills, as well as being most insanitary.

Signed:

BILLY LORD, Officer No. 666, Division No. 6.
Assistant to Chief Vollmer.
Chief of Los Angeles "Junior Times."
Deputy County Health Officer, L. A. County.

SOUVENIR ORAL HYGIENE DIVISION, LOS ANGELES COUNTY HEALTH DEPARTMENT

(over)

Fig. 5.—"Citation" issued by the Oral Hygiene Division of the Los Angeles County Health Department. The reverse side of the cards bears a picture of Billy Lord, little movie actor, attired as a policeman.

event. Last year, this paper also gave a truly wonderful cup, which will be presented each year to the school sending in the largest group of good posters on care of the teeth. It was awarded to the Sierra Madre grammar school last June. If the same school wins it three successive years, it is to become a permanent possession.

This year, a series of radio talks over KNX were given, during the mothers' hour programs. A full afternoon's program was put on, in one of the largest local department stores during the national child health week, and eight plays were given to different groups of both children and adults, including the annual

dental convention of the University of Southern California Dental College. The division had an exhibit at two dental conventions, and a demonstration and exhibit at the county fair and Southern California teachers' institute.

Dental lectures are given each year to the senior medical students, senior nursing students, nurses' institutes, special classes at the University of California, Southern Branch, and many other interested groups.

An educational dental film has just been finished. A great effort was made to have this picture simple and yet forceful and technically correct, so that it could be shown to either professional groups or school children—not so easy, perhaps, as it sounds.

As to figures? Yes, there are figures in plenty. There are statistics of schools with only about 7 per cent clean teeth when the work was started in the fall, brought up to 90 or 95 by summer vacation. But, in Los Angeles County, a school will close in June with 900 children and open in September with 1,400. Statistics, under these circumstances, do not really tell the story. But interesting records of individual children being brought up in scholarship, in attendance, in health, can be given. Also, there are records of schools that have had the dental work for several years competing in athletics with others that have not, and winning on every count. Records of schools can be shown in which almost all the children used to have green stain on their teeth, and now you will not find one. Yes, and this has even been impressed on the adult population as well. But, more than all, everyone is looking forward to big things from the prenatal and infant work in the future. This division is but one cog in the great wheel of the county health department, and an effort is being put forth to make this cog so fit in with all the others that there will be no jars and jolts but all run smoothly for the good of this and following generations.

Beginning with the May issue of THE JOURNAL, the Department of Dental Health Education will publish monthly a series of articles on nutrition by Kate Daum, Ph.D., research dietitian, University Hospitals, the State University of Iowa. In conjunction with the series, Dr. Daum will conduct a question and answer column on nutrition. Anyone having questions, will please send them to the Department of Dental Health Education.

Medical and Dental News

California

Dentists Support Student: The Tri-County Dental Association, including dentists of Riverside, Imperial and San Bernardino counties, is paying the expenses of Edward Shan, a Chinese student, now taking a four-year course in dentistry at a hospital in Anking, China. The young man intends to take up the practice of his profession in a district surrounding Nanchang, in Kiangsi province, where a million people are now without the services of a modern dentist.

Orthodontists Meet: The fifth annual convention of the Edward H. Angle Society of Orthodontia was held in Pasadena, February 15-26. Eighty delegates were present from all parts of the United States, and from Europe and Australia. Dr. R. H. W. Strang, Bridgeport, Conn., spoke on "Our Duty to Orthodontia;" Dr. Frederick B. Noyes, of Chicago, on "Some Thoughts on Etiology;" Dr. William H. Pearson, of Norfolk, Va., on "Abnormal Habits and Their Consequences;" Dr. Culmer C. Benton, San Diego, Calif., on "The Common Causes of Malocclusion;" Dr. Ernest M. Setzer, Oakland, Calif., on "The Law of Transformation of Bone and Its Application in Orthodontic Treatment;" Dr. Spencer R. Atkinson, of Atlanta, Ga., on "Effects on the Alveolar Process and Peridental Membrane of Protracted 'Jiggling' of Appliances or Teeth or Both;" and Dr. Frank A. Gough, Brooklyn, N. Y., on "Why the Babel of Tongues in Orthodontia?"

Idaho

Dental Clinics at Nampa: At the dental clinics established recently, at Nampa, examinations are being conducted at the rate of 150 per week. Clinics are held two days a week. Dentists are cooperating with the Red Cross, and the school nurse and volunteer nurses.

Kansas

Annual Dental Inspection: The annual dental inspection of all public school children of Leavenworth was held during the week beginning February 15. All dentists of the city participated in the inspection, which consumed about three days. Reports giving the condition of the teeth of the pupils are kept on file in the office of the board of education. The teeth of rural school children also are inspected every year.

Maryland

Midwinter Clinic of Baltimore Society: More than 200 dentists attended the midwinter clinics held under the auspices of the Baltimore City Dental Society, February 5-6. Dr. B. Lucien Brun, professor of dental surgery, Johns Hopkins University, and Dr. Alexander H. Patterson, of the University of Maryland, were among the speakers.

Michigan

Southwest District Dentists Meet: An all day conference and clinic was held at Kalamazoo, February 25, by the Southwestern Michigan Dental Association. Dr. W. E. Cummer, Toronto, Canada, held clinics, and also gave an illustrated lecture on special dental work. Following a banquet in the evening, Dr. C. J. Lyons, of Ann Arbor, spoke on dental conditions in Europe. Announcement was made that the Kalamazoo Dental Society has presented the Fairmont Hospital of that city with a complete dental outfit, which will make possible the establishment of a dental unit at that institution.

Dental Work for Children: Last December, the Dental Division of the Detroit Board of Health sent out the following questionnaire to the 540 members of the First District society: 1. Are you willing to make appointments for dental work for children between

the ages of 3 and 15 at your regular fees? 2. Do you do prophylaxis for children? 3. Do you do filling for children? 4. Do you do extracting for children? 5. Do you do orthodontia? In Detroit, 180 answered the first question in the affirmative; in Highland Park, two, and outside of Detroit, thirty-three. Thirteen did orthodontia only; two, extractions only, and three, prophylaxis only. It is estimated by the state society bulletin that 300,000 children in Detroit between the ages of 3 and 15 need fillings and extractions.

Minnesota

State Association Meets: The forty-third annual session of the Minnesota State Dental Association was held in St. Paul, February 10-12, with an estimated attendance of 1,500. Among the essayists were Dr. George Thompson, of Chicago, who spoke on "Dental Ceramics;" Dr. Norman S. Levy, Philadelphia, who spoke on "Esthetics in Denture Construction;" Dr. C. O. Simpson, St. Louis, who spoke on "Radiography;" Dr. W. V. McGilvra, St. Petersburg, Fla., who gave a clinic on "Gas Anesthesia," and C. N. Johnson, Chicago, who spoke on "Operative Dentistry." About sixty clinics were presented. Research clinics were given by the G. V. Black Dental Club of St. Paul and the Monson Research and Clinic Club. The annual banquet of the association was held at the St. Paul Athletic Club, February 10.

Dental Nurses and Assistants Meet: The sixth annual convention of the Minnesota State Dental Nurses and Assistants Association was held, February 10-12, in conjunction with the state dental association meeting. Dr. J. M. Wall, of St. Paul, gave the opening address, which was followed by table clinics on "Value of the Toothbrush," "Sterilization," and "Preparation of Surgical Dressings." Other clinics covered the subjects of nitrous oxid administration, investing and casting, mixing of cements and amalgams, orthodontia models, roentgen-ray work, waxing, investing, burning out and casting full veneer crowns, and the administration of procain. Dr. Alfred Owre, Minneapolis, addressed the association on "Dietetics from the Dental Viewpoint." Dr. Clarence O. Simpson, St. Louis, spoke on "Radiography," and a group of dental assistants discussed "The Business of Dentistry."

Montana

Third District Society Meets: The Third District Dental Society, recently reorganized, met at Butte to install its new officers, February 3. Dr. H. K. Von der Heydt gave a table clinic on "Indirect Inlays with a Water Swager," and Dr. Sherman Keyser discussed, "Why Dental Societies Fail." The following officers were installed: president, F. J. Hemmer; vice president, John B. Driscoll; secretary-treasurer, C. N. Bucher. The third district includes members from Anaconda, Deer Lodge, Dillon, Phillipsburg, Sheridan and Twin Bridges. The next meeting will be held at Anaconda.

North Carolina

First District Dentists Meet: The First District Dental Society of Western North Carolina met in Gastonia, February 15-16. Drs. R. A. Little and W. F. Bell, of Asheville, took part in the program.

New York

Bowling Green Clinic Opens: The clinic sponsored by the Bowling Green Neighborhood Association was opened, February 23, for the care of 1,500 school children of the Wall Street district. The clinic is supervised by Dr. Anna C. Hughes, of Columbia University, and the head nurse of the association.

Ohio

Dr. Keely Honored: A testimonial dinner was given Dr. Charles I. Keely, of Hamilton, March 2, in honor of his fiftieth anniversary in the dental profession.

Dental Inspector: The Cleveland Dental Society Bulletin carries the following announcement: "The Ohio Board of Dental Examiners has a full-time woman inspector. She intends to spend about two months in Cleveland, starting February 25. We owe the board all the cooperation possible to carry out the work which is uplifting to the profession and the protection to the public. Any member having knowledge of illegal practice in this city is requested to turn it in to the office of the society, in writing. Names of signers will be held in confidence."

Pennsylvania

Clinic for Adults: The establishment of a clinic for adults in need of dental care is proposed by the health division of the Council of Social Agencies of Reading. A plan

for the establishment of the clinic has been formulated by the dentists of the city. It is suggested that the work for clients of social and health agencies shall be done in private offices, to obviate the purchase of dental equipment.

Central Pennsylvania Dental Society Meets: About 200 members attended the annual meeting of the Central Pennsylvania Dental Society, February 22-24, at Johnstown. The next annual session, the twenty-fifth, will be held in Altoona. The following officers were elected for the ensuing year: president, John G. Shaffer, Altoona; vice president, John S. Isenberg, Johnstown; recording secretary. J. L. Porias, Nanty Glo (reelected); financial secretary, W. E. Black, Lewiston (reelected); treasurer, James W. Lyman, Johnstown (reelected).

Texas

Midwinter Clinic at Dallas: A three-day program of clinics was held in Dallas by the local society, February 8-10, with a study club conducted in the evening to discuss each day's clinics. Dr. Roy S. Hopkinson, Milwaukee, Wis., presented clinics on oral surgery; Dr. C. C. Sparrow, Minneapolis, Minn., on crown and bridgework, and Dr. F. M. Hight, Houston, Texas, on prosthetic dentistry.

Tennessee

Tenth District Society Elects Officers: The Tenth District Dental Society, last December, elected the following officers: president, R. B. Armstrong; vice president, R. B. Tavel; secretary-treasurer, E. J. Justis.

Virginia

Piedmont Association Meets: The eleventh annual session of the Piedmont Dental Association was held, February 26-27, at Roanoke. The society has a membership from South Boston, Brookneal, Chatham, Altavista, Lynchburg, Roanoke and Danville.

Wisconsin

Marquette Alumni Association Meets: The twentieth annual convention of the Marquette University Dental Alumni Association was held in Milwaukee, February 17-19, with 400 members in attendance. A symposium on the present status of focal infection was presented, February 17, the following essayists taking part: Dr. M. N. Federspiel, professor of oral surgery at Marquette University; Dr. Edward Miloslavich, professor of pathology, Marquette University; Dr. Thomas B. Hartzell, research professor of mouth infection. University of Minnesota, and Dr. U. G. Rickert, of the University of Michigan. On the second day of the session, papers were read by Dr. B. E. Lischer, of the University of Michigan, who spoke on "Incisor and Profile," and Dr. Hermann Prinz, of the University of Pennsylvania. On the last day of the session, Dr. Federspiel demonstrated the cleft palate operation, and papers were read by Dr. O. G. Krause, professor of crown and bridgework at Marquette, and Dr. Polk E. Akers, of Chicago.

Foreign

Dental Progress for 1925: The Dental Journal of Japan, in a recapitulation of the principal dental events of the past year, mentions the revision of the dental act, enjoining organization of dental associations, which all licensed dental surgeons are expected to join, and forbidding the unlicensed to open or keep a dental office; granting of the degree of LL.D to Dr. Chiwaki by Loyola University; admission of dental surgeons to the Tropical Medicine Congress; construction of the new building to house the dental department of Nihon University; establishment of two new dental dispensaries; and the establishment of "Good Teeth Day."

General

Anthropologist Wins Chaim Prize: The Morris L. Chaim prize of $250 has been awarded to Wilton M. Krogman, student in the anthropology department of the University of Chicago, for his work with human skulls, which has afforded new and striking evidence that the artificial feeding of children is responsible for misshapen teeth and mouths. Three hundred and seventeen Melanesian skulls from New Guinea, New Britain and New Hebrides groups were studied, and there was found a percentage of normal occlusion of 79.6. Artificial feeding is unknown among these peoples. The findings are in agreement with those of Dr. Milo Hellman, research fellow of anthropology in the American Museum of Natural History.

1925 Record Health Year: According to the figures available to the Metropolitan Life Insurance Company, 1925 was a record health year, a slight improvement being shown over

the figures for 1924. There were new minimum death rates for measles, scarlet fever, diphtheria, tuberculosis, all forms, and the diseases incident to pregnancy and childbirth. The two outstanding items were the splendid records shown in the drop in mortality for tuberculosis and the principal epidemic diseases of childhood.

Deaths

Baxter, William H., Northampton, Mass.; died of heart disease, February 2; aged 64.

Beissel, William J., Sr., Brooklyn, N. Y.; New York College of Dentistry, 1902; died suddenly, at Miami Beach, Fla., aged 51.

Clute, R. H., Greenwood, Wis.; Marquette University School of Dentistry, 1923; died suddenly February 10, in Milwaukee, where he was receiving throat treatment.

Cox, Norris R., Portland, Ore.; died, recently, aged 70. Dr. Cox was a practitioner of dentistry for nearly forty years.

Fancher, William Marlborough, Ossining, N. Y.; died suddenly, January 29, aged 68. Dr. Fancher was a charter member and the fourth president of the Ninth District Dental Society of New York, and at the time of his death was librarian of that organization. He is survived by the widow, three daughters and a son.

Ferguson, Benjamin R., Coldwater, Mich.; died, December 3; aged 51.

Foote, Lewis L.; Richland, Iowa; State University of Iowa, College of Dentistry, 1891; died, February 1, after a several months' illness.

Garretson, Charles F., Knoxville, Iowa; died, February 12, in Boise, Idaho; aged 86. Dr. Garretson practiced dentistry for fifty-seven years, being the oldest practicing dentist in Iowa. He retired five years ago.

McLaren, John S., Chicago, Ill.; Chicago College of Dental Surgery, 1903; died, January 16, following an operation for duodenal ulcer.

Vivian, Victor H., Ludington, Mich.; University of Michigan College of Dentistry; died, December 8, after a long illness; aged 57.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Control of Rickets: The study of a practical method of community control of rickets has been continued during the last year in New Haven, Conn., by the Children's Bureau in cooperation with the pediatric department of the Yale University School of Medicine. A preliminary report of the first eighteen months' work was given before the annual meeting of the American Medical Association, reprints of which will probably be available in the near future. That approximately 90 per cent of the infants examined developed rickets in its mildest form during the early months of life has been definitely demonstrated in the course of the study by X-ray photographs of the infants' bones taken at monthly intervals. If this mild form of rickets did not progress to a more severe degree, there was no apparent effect on the infants' general health. An investigation of the normal growth and development of infants from birth to two years is being made on this same group of children. The study will include not only a correlation of physical growth with general health but also a study of the actual growth of bone as shown by the X-ray photographs.—*Rep. Children's Bureau.*

Rheumatic Infection in Childhood: The onsets of acute rheumatism in the child, according to Poynton are: (1) cases showing fulmination, the patients readily recognized as being gravely ill; (2) a large group of cases in which sore throat, arthritis, and morbus cordis are the first symptoms; (3) another large group in which chorea and morbus cordis are the beginning symptoms; (4) a large group in which chorea only starts the disease; (5) a group in which heart disease alone may take the form of dilatation following sore throat as the cause, and (6) a group in which the rheumatism begins insidiously, usually with multiple symptoms that remit and exacerbate, thus producing the "rheumatic state." Poynton believes the tonsils to be an important site of infection. Skilled enucleation will not prevent a first attack of rheumatism and acute carditis of extreme severity occurring some years later. However, an acute and crippling attack of carditis may directly follow removal of the tonsils in the patient with rheumatism. The successful removal of unhealthy tonsils is a valuable prophylactic step if, undeterred by exceptions, we view the problem on broad lines. Poynton believes that every case must be considered as an entity. He does not favor routine action. He holds that the teeth and gums of children should be kept as healthy as possible, but he can trace no clear connection between acute rheumatism and dental disease in childhood.—*Brit. M. J.*

Incidence of Caries in Permanent Teeth: The report indicates no significant sex difference. Taking both sexes together the incidence of caries is higher in the lower molars than in the upper; and higher in the upper incisors and permolars than in the lower. In comparing one type of tooth with another, it is seen that the first permanent molars, which have been present in the mouth for the longest time, show the highest incidence of caries at all ages. If the incidence of caries is calculated for each tooth at a period of approximately one year from the average date of eruption, it will be found that the incidence is highest in the lower second molars (28.2 per cent at 12-13 years), and the subsequent order, in a descending sequence is: lower first molars (23.5 per cent at 7 years), upper first molars (14.6 per cent at 7 years), upper second molars (13.4 per cent at 13 years), upper second premolars (3.6 per cent at 11 years), upper central incisors (0.6 per cent at 8-9 years), upper lateral incisors (0.4 per cent at 9-10 years.) This gives a clear and valuable indication of the relative liability of these teeth to caries.—*Rep. Com. Dent. Dis. Med. Res. Council.*

Tooth Destruction in Pregnancy: Kerwin urges that all necessary dentistry during pregnancy should be done regardless of the duration of pregnancy. The aim at tooth preservation is one of the obstetrician's duties. Better teeth can be given to the newborn by proper prenatal care. Pregnant women should use frequently an alkaline mouth wash and take calcium throughout the pregnancy.—*Missouri M. A. J.*, abstr. *J.A.M.A.*

X-Ray Treatment of Tonsillitis and Chronic Pharyngitis: The extreme susceptibility of lymph tissue to the x-ray and its immunizing effect on the tissues in local infections, are the two cardinal principles upon which the x-ray method of treatment is founded. Heinicke, in 1905, first pointed out the fact that lymph tissue was very readily destroyed by small doses of x-ray. Murphy and Ellis were able, by suitable exposures, to remove almost all of the lymph tissue in animals, without inducing detectable changes in other organs or tissue. Taylor and Murphy found that, when the doses of x-ray were properly graded, even the total number of polymorphonuclear leucocytes remained unaffected, while the lymphocytes fell to a point at which few were seen in the circulating blood. With our present-day methods of x-ray technic, the results obtained in lymphosarcoma, Hodgkin's disease, lymphatic leukemia, and splenomedullary leukemia are not only examples of the effects of x-ray on lymph structures, but also substantiate the fact that suitable doses remove lymph tissue without inducing detectable changes in any of the adjacent glands or tissues.—W. D. Witherbee, in *J. Dent. Res.*

Total and Subtotal Restoration of the Nose: To be acceptable, a surgically reconstructed nose, says Vilray P. Blair (*J.A.M.A.*) must be covered with a smooth skin, have a normal contour, have an epithelial lining, and provide an adequate airway. Though not always necessary, a rigid support of bone or cartilage will usually add to the quality of the result. It is very desirable that the size and form of the new nose be in harmony with the particular face. Nasal reconstruction amounts to sculpturing with the live tissues for material, and this must be done in conformity with good surgical usage, combined with mechanical accuracy and some artistic feeling. Blair describes his method of procedure.

Objective in Mouth Hygiene Work: Even in our public dental work there is no unity of program or policy. Some believe it should be only educational and employ hygienists only. Others are doing all kinds of dental work for children, including root treatments, resections and orthodontia. Some with the largest budgets are confining their work to fillings in the younger grades, prophylaxis, and extractions. Some are self supporting. Some have a small fee. Some of them do not. Some accept any children, others only those from the poorest families. There seems to be no agreement as to the ones eligible for clinic dental service. We hear quite a little about the danger of pauperizing the child with free dental service, but why does it pauperize a child to give it free dental service when it does not pauperize it to give it a free education? Which is the more important for the state to give its children, education or health? Some clinics attempt to give each child who is receiving careful and painstaking attention. Others seem most insistent on numbers. Shall a clinic be judged by its propaganda and figures, too often intended for political purposes, or by the actual results in the children who have passed through it and the per capita cost for actual corrections obtained through its work and influence? Some clinics operate only during the school year, others the entire year. Some employ full-time dentists, others mostly part-time operators who are trying to get a start toward a private practice. Few are in it from love of the work or expect to stay in it. All honor to the unselfish members of our profession who have given freely of their time and effort without pay, and often at great personal sacrifice to get something started. They have done a splendid piece of pioneer work for which the public and the profession must ever be grateful. We are now past that stage and have a larger responsibility. We hope we have emphasized anew the real objective of our oral hygiene education, which is the removal and prevention of infection, and the part the dentist must play in accomplishing this result; also the need of more correction of our aims and program. The public is being aroused by the campaign of education in behalf of oral hygiene. Is the dental profession going to do its part?—*Mich. State Dent. Soc. Bull.*

Arthroplasty of the Temporomaxillary Joint: The operation described by Fulton Risdon, (*J.A.M.A.*), consists in removal of

the condyle and the filling of the glenoid area with free fascia lata from the hip. The shaping of the ascending ramus from which the head of the condyle has been removed is of great importance. It should be pointed anteroposteriorly and narrow laterally, so that the new head will be diamond-shaped, and as narrow or thin as possible, in this way allowing for a very small attachment of fibrous tissue. The most satisfactory results obtained were in cases of extra-articular trismus due to the union of the coronoid process to the inner surface of the zygoma or to the base of the pterygoid process of the sphenoid. This was of traumatic origin. In these cases, the coronoid process was resected but the joint was left intact, and the result was excellent. Another feature of these cases that should not be neglected is the recession of the chin. A seventh or eighth rib of the proper curvature and length should be taken from the patient and inserted over the metal process of the lower jaw.

Education in Preventive Dentistry: The medical men are teaching mouth hygiene in the hospitals to diabetic and gastric ulcer patients. You are going to be shocked when, in the near future, your patient replies to your suggestion of oral hygiene, "Oh, yes, my physician is teaching me all about the deleterious effects of an unclean mouth." We are allowing the physicians to take possession of this part of our duty, and to teach it to their patients and rightly take the credit. I said to a staff member in the Harvard Medical School, "You are appropriating the salient point of dentistry." He replied: "I admit it. We are teaching this for the benefit of the patient, because the dentist is not doing it." Yet the great majority of dentists sit still and allow the medical fraternity to seize this most important phase of dentistry and add it to the foundation of preventive medicine.—*J. Dent. Res.*

The Tooth Extracting Mania: In a letter to the *Lancet*, Sir Chichester Gould May, the famous medical specialist, says: "Since X-raying of teeth came into fashion, the tooth-extracting mania is worse than ever. Judging by my experience, everyone whose apparently sound teeth are X-rayed is said to have diseased ones. Two of my patients recently went to an oculist. He had their teeth X-rayed. A patient went to an aurist and one to laryngologist; they had their teeth X-rayed also. The verdict in each case was that several teeth ought to be extracted. All these patients had more or less recently seen their dentists, who had found nothing wrong with their teeth. I am informed that Continental medical men do not attribute anything like the same importance to the condition of the teeth as we do, and think we have gone crazy on the subject. I am disposed to agree with them."—*Dent. Surgeon.*

Carbon Dioxid as an Aid in General Anesthesia: Personal experience has convinced John S. Lundy (*J.A.M.A.*), that carbon dioxid in moderate concentration assists in producing anesthesia, rendering the anesthetic apparently safer and easier to administer. Carbon dioxid should be used in such concentrations as will produce optimal results, and these vary with the individual and the type and stage of the operation. Too much carbon dioxid is worse than none, and care should be exercised to prevent more than 5 per cent being used. The results thus far in a series of 1,350 cases in the Mayo Clinic are satisfactory enough to warrant further investigation by others in the use of carbon dioxid during the induction and maintenance and at the termination of ordinary general anesthesia.

Danger of Disease Transmission Prevented Through New Sterilizer Device: A forerunner of even greater safeguards in the practice of dentistry is an instrument eliminating practically all danger of infection from the dental drill or holder. The dental drill is used continually in the mouths of patients. Sterilization is almost impossible under present working conditions. Dental methods inhibit the disconnection and sterilization of the dental hand piece or drill holder, for each individual patient upon whom the dentist works. As these sections of dental tools come into contact with patient's mouths, the profession has found for years annoyance, trouble and anxiety over proper and practicable sanitation and sterilization in their use. All other implements employed by dentists in patients' mouths may be sterilized, except the hand piece or drill holder. Seldom if ever is the drill holder sterilized for each patient, as is the habit with other tools. Excuse for this lies in the mechanics of the tool. In the hand piece or drill holder are revolving parts and bearings that require lubrication in oil. If this tool were sterilized by boiling, or by immersion in gasoline, alcohol, or any other solution similar in constituents or re-

sults, these bearings would be spoiled and the handpieces gummed up. Gasoline, alcohol or allied solutions used for such sterilization would cut the oil and dry the running bearings. Mere wiping with alcohol or kindred solutions does not sterilize the drill holder. Such wiping or swabbing falls short of removing all disease spores, as is evident even to the laity, considering that a fatal disease germ can live on an area the size of the prick of a pin, or less. Now drill and holder are being inserted continually into the mouths of successive patients, or are in the hands of the dentist, whose fingers are moist from saliva from the oral cavities in which he labors. Value of a practical, adequate sterilizing device for the hand piece or drill cannot be overestimated.—*Illinois M.*

Care of the School Child: Although the regular semi-annual visits to the doctor and to the dentist are invaluable investments essential in preparing the child for his school life, they do not bring about any magical results that do away with the necessity for the careful daily safeguarding of the child's health, which parents must provide. A day never passes without leaving its effect, good or ill, upon the child's health, and what that effect will be rests more definitely with the father and mother than anyone else. Among parents' most important responsibilities are: providing for their children regular long hours of sleep, with windows open; regular, vigorous play out-of-doors; regular, nutritious simple meals, and the regular tonic and cleansing bath. The ill effects of failing to provide for these necessities of healthful living are not always immediately apparent, but the cumulative effects are sure and far-reaching.—Thomas D. Wood and Marion O. Lerrigo, in *Hygeia.*

Fatigue and Susceptibiltiy to Infection: A review of the various factors that may enter into the conservation of human health and help to determine resistance to disease would reveal a formidable array of proved or assumed phenomena. Environment and heredity can unquestionably be directive influences, but even under conditions in which these are most favorable there may be health hazards that are determined by other personal factors.

It has been said that the success of a baneful parasite in invading the body and producing reactions that reach the threshold of clinical symptoms may depend on conditions that either "favor the parasite or disarm the host." Such are the workings of the so-called predisposing causes of disease. They may be described vaguely by such utterly indefinite terms as lowered vitality, decreased resistance, increased susceptibility to infection, or lack of physical stamina. From the standpoint of practical hygiene and preventive medicine, it might be more conducive to progress if the factors were more specifically defined, so that they might be made the subject of direct critical investigation. Some of the harmful influences have been described as exposure to wet and cold, lack of fresh air and sunshine, insufficient or unsuitable food, fatigue and traumatism. One of these, fatigue, has been made the subject of study from the standpoint of its influence on susceptibility to infection. It is generally believed that most disorders of this class, as smallpox, measles, epidemic influenza, infantile paralysis, typhus fever, tetanus and yellow fever, have little or no relation to bodily vigor. On the other hand, there is a widespread assumption that predisposing factors are concerned in the immunity to such infections as tuberculosis and pneumonia. Bailey induced fatigue artificially in varying degrees of severity in experimental animals, and observed their relative susceptibility to intratracheal injections of pneumococci. The results seem to indicate that acute fatigué, in the form of physical exhaustion, and chronic fatigue, in the sense of training, are followed by quite opposite effects in the case of pneumonic infection. The first seems to render the animals more susceptible; the second, less susceptible. It would be premature to dogmatize on such preliminary observations under conditions not always easy of exact evaluation. Nevertheless, it need not be concealed that Bailey's findings, as he himself concludes, agree with the general belief that sudden overwork and strain may be detrimental, whereas physical training may increase resistance to certain infections—*J.A.M.A.*

Announcements

CALENDAR OF MEETINGS*

NATIONAL SOCIETIES

American Dental Golf Association, August 23, 1926, Philadelphia, Pennsylvania.

American Dental Hygienists Association, August 23-28, 1926, Philadelphia, Pennsylvania.

American Dental Society of Europe, April 5-7, 1926, Nice.

American Medical Association, April 19-23, 1926, Dallas, Texas.

American Society of Orthodontists, August 16, 1926, New York City.

International Orthodontic Congress, August 16-20, 1926, New York City.

Pacific Coast Dental Conference, June 21-26, 1926, Portland, Oregon.

Seventh International Dental Congress, August 23-28, 1926, Philadelphia, Pennsylvania.

Canadian Dental Association, August 16-19, 1926, Halifax, N. S.

Ontario Dental Association, May 17-20, 1926, Toronto, Canada.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

National Capital at Washington, D. C., first Tuesday of every month.

April (1926)

Alabama, at Birmingham (5-7).
Connecticut, at Bridgeport (8-10).
Kansas, at Wichita (19-21).
Kentucky, at Louisville (5-7).
Michigan, at Detroit (12-14).
Mississippi, at Meridian (13-15).
New Jersey, at Trenton (14-17).
North Carolina, at Richmond, Va. (13-15).
Oklahoma, at Tulsa (27-30).
Texas, at Wichita Falls (27-29).
Virginia, at Richmond (13-15).

May (1926)

Arkansas, at Little Rock (17-19).
Illinois, at Springfield (11-13).
Indiana, at Indianapolis (17-20).
Iowa, at Des Moines (4-6).
Maryland, at Baltimore (3-5).
Massachusetts, at Boston (3-7).
Missouri, at Jefferson City (17-19).
Nebraska, at Lincoln (17-20).
New York, at New York City (19-22).
North Dakota, at Grand Forks.
South Carolina, at Columbia (10-12).
South Dakota, at Sioux Falls (11-13).
Southern California (17-20).
Tennessee, at Nashville (4-7).
Vermont, at Burlington (26-28).
West Virginia, at Clarksburg (17-19).

June (1926)

California, at Portland, Ore.
Colorado, at Colorado Springs (9-12).
Georgia, at Savannah (9-11).
Maine, at South Poland (21-23).
Montana, at Helena (15-17).
New Mexico, at Santa Fe (10-15).
Oregon, at Portland.
Washington, at Portland, Ore. (21-26).

July (1926)

Wisconsin, at Milwaukee (13-15).
Wyoming, at Lander (12-13).

August (1926)

Pennsylvania, at Philadelphia (23-27).

October (1926)

Florida, at Daytona.

*Announcements must be received by the ninth of the month in order to be published in the forthcoming issue of THE JOURNAL.

November (1926)

Arizona, at Phoenix.

December (1926)

Nevada, at Reno (4).
Ohio, at Columbus (7).

Connecticut Dental Hygienists Association, at Bridgeport, April 9, 1926.

Dental Hygienists Association of the State of New York, at New York City, May 20-22, 1926.

Loyola University Dental Department Homecoming, Chicago, April 12-13, 1926.

Odontological Society of Western Pennsylvania, at Pittsburgh, November 29-December 1, 1926.

Northern Ohio Dental Association, at Cleveland, June 7-10, 1926.

MEETINGS OF STATE BOARD OF DENTAL EXAMINERS

Indiana, at Indianapolis, June 14, 1926. Secretary, J. M. Hale, Mt. Vernon, Indiana.

Montana, at Helena, July 12-16, 1926. Secretary, Marshall E. Gates, Helena, Montana.

Nevada, at Reno, May 12, 1926. Secretary, G. H. Marven, Reno, Nevada.

New Jersey, at Trenton, June 28-July 3, 1926. Secretary, John C. Forsyth, 148 W. State Street, Trenton, New Jersey.

New Mexico, at Santa Fe, June 10-12, 1926. Secretary, J. J. Clarke, Artesia, New Mexico.

Oklahoma, at Oklahoma City, in June. Secretary, Charles A. Hess, Idabel, Oklahoma.

Rhode Island, at Providence, June 22-24, 1926. Secretary, Albert L. Midgley, 315 Butler Exchange Building, Providence, Rhode Island.

South Dakota, at Sioux Falls, June 28. Secretary, G. G. Kimball, Mitchell, South Dakota.

Texas, at Houston, June 7-9, 1926. Secretary, G. C. Baker, Kaufman, Texas.

Department of Registration and Education, State of Illinois, at Chicago, June 15-19, 1926. Superintendent of Registration, V. C. Michels.

MAINE DENTAL SOCIETY

The sixty-first annual meeting of the Maine Dental Society will be held in Poland Spring House, South Poland, June 21-23, 1926.

W. F. Fogg, *Secretary*,
Waterville, Me.

MICHIGAN STATE DENTAL SOCIETY

The seventieth annual meeting of the Michigan State Dental Society will be held at the Statler Hotel, Detroit, April 12-14. A carefully arranged program has been prepared.

Irvin H. Ante, of Toronto, will read a paper and give a clinic on inlays and bridge attachments. Rupert E. Hall, of Chicago, will speak on prosthetics; James Roy Blaney, of the University of Illinois, Chicago, on root canal therapy; Howard F. Lewis, Rochester, N. Y., on physiologic chemistry; Chalmers J. Lyons, of Ann Arbor, on public health, and Frank J. Sladen, of the Henry Ford Hospital, Detroit, on focal infection. U. G. Rickert, Ann Arbor, and the Pulpless Tooth Section of the Detroit Clinic Club, will also take part in the program, and Miss Evelyn C. Schmidt, Chicago, director of the Department of Dental Health Education of the American Dental Association, will read a paper. The Orthodontia Section of the Detroit Clinic Club will demonstrate practical cases that come within the field of the general practitioner. A group of twenty local dentists will give table clinics. All ethical dentists are invited.

Pat J. O'Reilly, *Publicity Chairman*,
4622 Grand River Ave.,
Detroit, Mich.

MONTANA STATE DENTAL ASSOCIATION, INC.

(Change of Dates)

The Montana State Dental Association will meet June 15-17, at Helena.

J. E. Buehler, *Sec'y-Treas.*,
411 Ford Bldg.,
Great Falls, Mont.

MISSISSIPPI STATE DENTAL SOCIETY

The next meeting of the Mississippi State Dental Society will be held at Meridian, April 13-15, 1926.

A. A. ALLEN, *Secretary*,
Amory, Miss.

NORTHERN OHIO DENTAL ASSOCIATION

The Northern Ohio Dental Association will meet in Cleveland, at the Hotel Winton, June 7-10, 1926. Golf will be played, June 7, and the program will be given the following days. Seven educational and practical clinic courses have been arranged.

E. S. BRAITHWAITE,
Chairman of Publicity,
Griffin-Meier Bldg.,
Willard, Ohio.

ONTARIO DENTAL ASSOCIATION

The annual convention of the Ontario Dental Association will be held at the King Edward Hotel, Toronto, May 17-20, 1926. An excellent practical program has been arranged. Dentists from points outside Ontario are cordially invited.

FRED J. CONBOY, *Secretary*,
Spadina House, Toronto, Can.

SOUTH CAROLINA STATE DENTAL ASSOCIATION

The South Carolina State Dental Association will meet, May 10-12, 1926, at the Jefferson Hotel, Columbia.

M. L. BROCKINGTON, *Directing Secretary*,
Florence, S. C.

DEPARTMENT OF REGISTRATION AND EDUCATION, STATE OF ILLINOIS

The next examination for license to practice dentistry in Illinois will be held June 15-19, 1926, at Chicago. For applications (which must be filed at least ten days before the examination) and other information, address the Department of Registration and Education, Springfield.

V. C. MICHELS,
Superintendent of Registration.

NEVADA STATE BOARD OF DENTAL EXAMINERS

The Nevada State Board of Dental Examiners will hold their next examination at Reno, beginning May 12, 1926. All applications must be filed with the secretary not later than May 1, 1926.

G. H. MARVEN, *Secretary*,
Reno, Nev.

NEW MEXICO STATE DENTAL BOARD

The next meeting of the New Mexico Board of Dental Examiners will be held at Santa Fe, June 10-12, 1926. Applicants can obtain full information by addressing

J. J. CLARKE, *Secretary*,
Artesia, N. Mex.

SOUTH DAKOTA STATE BOARD OF DENTAL EXAMINERS

The next meeting of the South Dakota Board of Dental Examiners will be held in Sioux Falls, S. D., beginning June 28. All applications must be in the hands of the secretary at least two weeks prior to the examination.

G. G. KIMBALL, *Secretary*,
Mitchell, S. Dak.

TEXAS STATE BOARD OF DENTAL EXAMINERS

The Texas State Board of Dental Examiners will meet in Houston, June 7-9, 1926. For further information address

G. C. BAKER, *Secretary*,
Kaufman, Texas.

CONNECTICUT DENTAL HYGIENISTS ASSOCIATION

The eleventh annual convention of the Connecticut Dental Hygienists Association will be held at Bridgeport, in the Lyon Terrace High School, April 9, 1926.

ELLA M. MAHER, *Secretary*,
62 Trumbull St.,
New Haven, Conn.

ODONTOLOGICAL SOCIETY OF WESTERN PENNSYLVANIA

The annual meeting of the Odontological Society of Western Pennsylvania will be held on the seventeenth floor of the William Penn Hotel, Pittsburgh, Pa., Nov. 29-Dec. 1, 1926.

LESLIE WADDILL, *Secretary*,
Pittsburgh, Pa.

DUTCHESS-PUTNAM DENTAL SOCIETY

The Dutchess-Putnam Dental Society is sending out advance notices for the two coming meetings.

At the March meeting, Dr. Paul R. Stillman, of New York City, will be the guest and essayist.

At the May meeting Dr. William F. Chapelle, of Buffalo, is to present a clinic and a lecture, which will be discussed by Dr. H. A. Cheney of Yonkers.

At the May meeting, the dinner, at 6:30 p. m., will take the form of a banquet to four of our older members, who have been in practice about fifty years: Drs. H. F. Clark, and P. L. Foote, Poughkeepsie; Edward Cowles, of Beacon, and John Hobbs of Red Hook.

It is expected that Dr. Fiero, state society president will make the afternoon address, and there will be remarks by some of our younger practitioners.

STEPHEN PALMER, *President*,
272 Mill St., Poughkeepsie, N. Y.

PATENTS OF INTEREST TO DENTISTS

1472272. Dental chair, George D. Heck, Prince Bay, N. Y.

1472677. Tooth and preparing the same, U. M. Richardson, Chicago, Ill.

1472678. Tooth construction, U. M. Richardson, Chicago, Ill.

1473276. Dental flask, Martin F. Burns, Astoria, N. Y.

1473277. Dental flask, Martin F. Burns, Astoria, N. Y.

1473278. Dental apparatus, Martin F. Burns, Astoria, N. Y.

1472975. Molding flask, Leon S. Greenberg, Newark, N. J.

1473357. Toothbrush, Abraham Pletman, Schenectady, N. Y.

1473482. Composition of matter for filling root canals in teeth, Paul M. Kruger, Attala County, Miss.

1473055. Interchangeable facing and backing, Thomas Steele, Columbus, Ohio.

1473000. Toothbrush, Wayne L. Weatherwax, Oshkosh, Wis.

1473661. Attachment for partial plates or removable bridges, Charles C. Baker, Pittsburgh, Pa.

1473673. Holder for artificial sets of teeth, Edward J. Elsas, Scott City, Kan.

1473766. Toothbrush, Charles F. Healy, New York, N. Y.

1474084. Dental appliance, Frank T. McClaskey, Sacramento, Calif.

1474174. X-ray film holder, Aaron Segall, New York, N. Y.

1475105. Breather deflector, Niels W. Aasen, Christiania, Norway.

1474620. Apparatus for forming dental inlay castings, R. T. Case, La Crosse, Wis.

1474370. Dental surgery, L. A. Kiander, New York, N. Y.

1474497. Dental appliance, Isaac Stolper, New York, N. Y.

1474988. Cheek plate, Arthur H. Weston, New York, N. Y.

1475102. Toothbrush, Robert M. Withycombe, Sydney, Australia.

1475789. Implement for cleaning teeth, Thomas A. Buckley, Brooklyn, N. Y.

1475808. Dental bridge, Joseph B. Foster, Roanoke, Va.

1475354. Dental instrument, Wm. M. Stanbrough, Newburgh, N. Y.

1476579. Toothbrush, Henry Barnes, Cleveland, Ohio.

1476048. Grid for protecting Roentgen images against secondary rays, Gustav Bucky, Berlin, Germany.

1476356. Adjustable sanitary fountain-cup attachment for dental cuspidors, Ira A. Burnett, Chicago, Ill.

1476357. Dental mandrel, Ira A. Burnett, Chicago, Ill.

1476324. Dental casting flask, heater and instrument sterilizer, John E. Burns, Flushing, N. Y.

1475996. Apparatus for casting dental plates in metal, Herbert L. Hobday, and F. W. Nunn, Melbourne, Australia.

Copies of these patents may be obtained for twenty-five cents each, by addressing John A. Saul, Solicitor of Patents, 509 Seventh St., N.W., Washington, D. C.

SEVENTH INTERNATIONAL DENTAL CONGRESS

There will be available for advanced registration of the delegates to the International Dental Congress in Philadelphia during the week of August 23 to 27, 1926, hotel accommodations as follows:

Hotel	Capacity, persons	Rate per room per day
BELLEVUE-STRATFORD, S. W. Cor. Broad and Walnut Sts.	800 to 1000	$4.00 to $8.00
RITZ-CARLTON, S. E. Cor. Broad and Walnut Sts.	150	7.50
WALTON, Broad and Locust Sts.	400	4.00 to 6.00
STENTON, Broad and Spruce Sts.	50	5.00
THE SPRUCE, 13th and Spruce Sts.	200	4.00 to 6.00
SYLVANIA, Locust and Juniper Sts.	400 to 500	5.00 to 6.00
VENDIG, 13th and Filbert Sts.	300	3.50 to 4.00
WINDSOR, 1219-29 Filbert St.	200 to 300	4.00 to 5.00
HANOVER, N. W. Cor. 12th and Arch Sts.	200 to 300	4.00 to 5.00
ADELPHIA, 13th and Chestnut Sts. (*all rooms with bath*)	600	4.00 to 5.00
ST. JAMES, 13th and Walnut Sts.	300 to 400	4.00
ALDINE, 19th and Chestnut Sts.	100	4.00 to 5.00
ELK CLUB, Broad and Wood Sts. (*Men only*)	100	4.00
LORRAINE, Broad St. and Fairmount Ave.	250	3.00 to 6.00
MAJESTIC, Broad St. and Girard Ave.	200	3.00 to 6.00
PENNSYLVANIA, 39th and Chestnut Sts.	400	2.50 to 3.00
GREEN HILL FARMS, City Line and Lancaster Pike	40 to 50	5.00 to 6.00
BARTRAM, 33rd and Chestnut Sts.	250	3.00
ROBERT MORRIS, 17th and Arch Sts.	250	3.50 to 4.00
BELGRAVIA, 1810 Chestnut St.	70	3.50 to 9.00
CLINTON APTS., 10th St., below Spruce St.	100	4.00 to 5.00
STRATHMORE, 12th and Walnut Sts.	90	2.50 to 3.00
MARLYN APTS., 40th and Walnut Sts.	20	4.00 to 5.00
WASHINGTON, 7th and Dauphin Sts.	300	3.50
PENN ATHLETIC CLUB, 18th St. and Rittenhouse Square (*Men only*)	150	3.50 to 4.50
GIRARD CRAFTSMEN CLUB, 2027 Chestnut St. (*Men only*)	25	5.00 to 9.00
Y. M. C. A., 1425 Arch St. (*Men only*)	50 to 100	1.50 to 2.50
Y. W. C. A., 18th and Arch Sts. (*Women only*)	25	1.00 to 1.50
WALT WHITMAN, Broadway and Cooper St., Camden, N.J.	100	3.50 to 4.00
PHILADELPHIA YOUNG FRIENDS' ASSOCIATION, INC. Fifteenth and Cherry Sts.	20	4.00 to 4.50

Apartments

The following apartment houses have accommodation for a limited number at prices ranging from $10 to $20 per person per week.

3935 Baltimore Ave., C. Cox.
4218 Baltimore Ave., E. Esnard.
3331 Chestnut St., J. J. Boyle.
3338 Chestnut St., E. Krakow Apartments for women.
4526 Sansom St., J. H. Newkirk.
3706 Spruce St., C. B. Marriott.
4818 Trinity Place, F. M. Millbourne.
3805 Walnut St., E. N. Simpson.
4311 Walnut St., P. A. Cortsen.
5126 Walnut St., J. B. McMillan.
5239 Walton Ave., M. E. Bussom.
108 S. 36th St., F. M. Katar.
330 S. 42nd St., M. C. Lowrie.
323 S. 46th St., H. V. Bechtold.
906 S. 46th St., D. Mackenzie.
1005 S. 49th St., F. Buckley.

Because of the many conventions coming to Philadelphia this same week, it is most desirable and necessary to reserve rooms *at once*. Requests for reservations should be directed to the hotel, apartment house or club. This is absolutely insisted on on account of the allotment of space which they have furnished to the Committee on Hotels for the Congress. Do not delay! It is suggested by the Hotel Association that whenever and wherever possible more than two occupy a room on account of the great demand for space during the Sesquicentennial period.

W. C. T. BAUERLE, *Chairman*,
Local Committee on Hotels,
Flanders Bldg., Philadelphia, Pa.

MAIL THIS APPLICATION DIRECT TO HOTEL

HOTEL RESERVATION

Seventh International Dental Congress, Philadelphia, Pa., August 23 to 27, 1926

..... Hotel. 1926

Philadelphia, Pa.

Please reserve accommodations noted below, beginning August .....

to August .....

..... Room (s) with bath for ..... people. Rate desired $ .....
(per day)

..... Room (s) without bath for ..... people. Rate desired $ .....
(per day)

List names and addresses of all who will occupy the room with you.

Name ..... Address .....
Street, City and State.

Name ..... Address .....
Street, City and State.

Name ..... Address .....
Street, City and State.

Name .....

Street .....

City ..... State .....

A Sign for Safety

By Ernest V. Madison

In buying products advertised in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION we are practically assured that:

> *On the initial order*, the advertiser will give the best quality he can make at the lowest selling price he can take.
>
> *On subsequent, or "repeat" orders*, the original marketing policy will be continued.

Maintenance of quality becomes a necessity with an advertiser. His ultimate profit is dependent on a continued patronage from customers gained by advertising. He cannot risk lowering his standard of quality on repeat orders.

The advertisements of the different manufacturers found in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION may be likened to signs or guideposts along a highway, which signs point to continued safety for the buyer.

If you were traveling over the highways in constantly changing territories, wouldn't you read the signs that would guide you toward the smoother and shorter roads?